American Machinist

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AUTOMOTIVE PRODUCTION on a JOBBING BASIS—I

JOHN HAYDOCK
Managing Editor, American Machinist

PARTS FOR 35 different automobiles and trucks flowing through one plant simultaneously — set-ups changed continually to make way for the new designs of a score of manufacturers—machinery bought in the United States saddled with a 35 per cent premium; these are but a few of the unusual conditions that make life interesting for the production executive at McKinnon Industries.

Located at St. Catharines, Ontario, this plant is just 20 miles from the Niagara border. It is a division of General Motors, but only about 50 per cent of its output goes to this corporation; Chrysler, Hudson and International Harvester are among its customers.

Automotive products include axles, shock absorbers, drive shafts, differentials, A. C. spark plugs, starters and generators. Wrenches of all kinds—open end, Stillson and Crescent types—are made here. It soon will be turning out automotive transmissions. Even within the General Motors Corporation McKinnon's is regarded by assembly units as an outside supplier and must justify its existence by a comparison with costs obtained in Detroit and in other divisions.

Most automotive plants work a year or more on identical parts, but at McKinnon's ten days is a long run. Obviously, the problem of manufacture must be approached differently here than at plants working a single line of cars. Methods and machines must have the flexibility needed to change over from one job to the next, quickly and economically; the men in the shop must have a wider range of skill than is found in the ordinary automobile plant.

Selection of tooling and equipment is a prime consideration in any high production plant, but at McKinnon's this activity becomes doubly important because of the added cost of imported machinery and because of the higher degree of versatility required.

There are twelve types of axle shafts produced at the St. Catharines plant. That for the 1935 Chevrolet has a large flange at one end and is made of chrome-nickel steel, corresponding to SAE 3140; all diameters are parallel to the axis.

Both ends are centered on a centering machine, and in the same operation, two holes are drilled in the flange to provide driving means for the turning operation. After straightening, the shaft is turned in two sets of operations, both of which are performed on Fay lathes. The first rough turns all diameters, faces the flange and cuts in the shoulders; the second operation, which is quite similar, is shown in Fig. 1. Here twelve tools perform the finishing operations; in addition to those in the front and back tool rests, an auxiliary tool post is fed upward from the underside of the work and finish faces the back of the flange. Cobalt

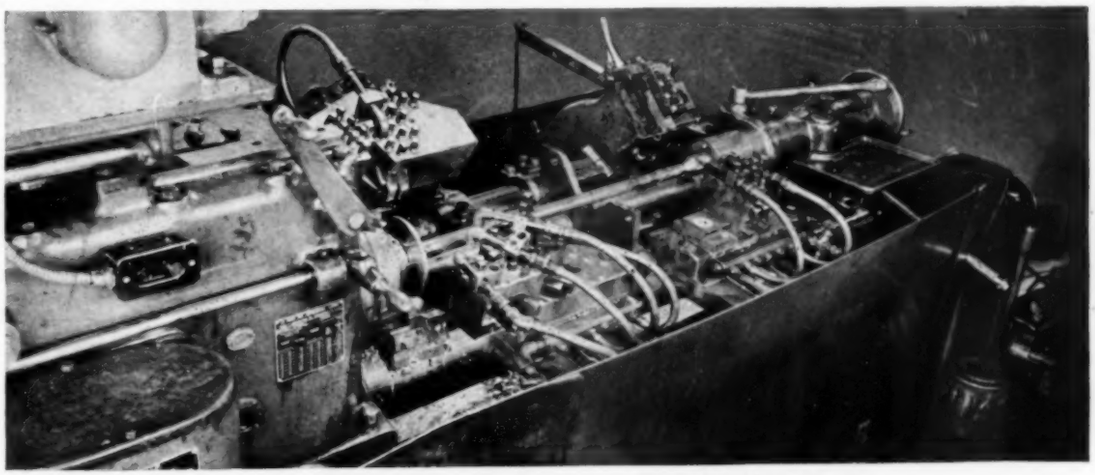

Fig. 1—A 1935 Chevrolet axle shaft is finish turned using twelve tools

high-speed tools are used under a heavy stream of soluble cutting oil.

Another type of axle shaft that must be machined is that for the Chevrolet truck. This piece has no flange, but does have a long taper cut at one end. For turning this part a Fay center-drive lathe is used, as shown in Fig. 2. Rough machining the tapered end is done by tools mounted in the front carriage; the back carriage holds a large forming tool which finishes the entire end to the proper size. While the former is an expensive tool, it carries two edges so that it may be reversed after one edge has worn dull; it combines the finishing and roughing operations in the same machine.

The taper attachment for the roughing cut may be clearly seen in the illustration. It consists of a wedge which is held stationary while the tool block is being fed along the bed of the machine. A stiff spring holds the toolpost which carries the cutter for this operation against the wedge, causing it to recede as the block moves toward the headstock. The taper may be adjusted for other shafts by changing the wedge used in the taper attachment. While these operations are being performed, the carriage at the head end of the lathe turns the other end of the shaft.

The shaft shown in Fig 2 is heat-treated before turning, whereas flange type shafts, such as shown in Fig. 1, are completely turned before being heat-treated. After turning, the flange shafts are splined on a Barber-Colman machine, and then grooved and faced on the small end in a Hall planetary milling machine.

Nine holes in the flange are then drilled in a multi-spindle machine and six of them countersunk. The man who

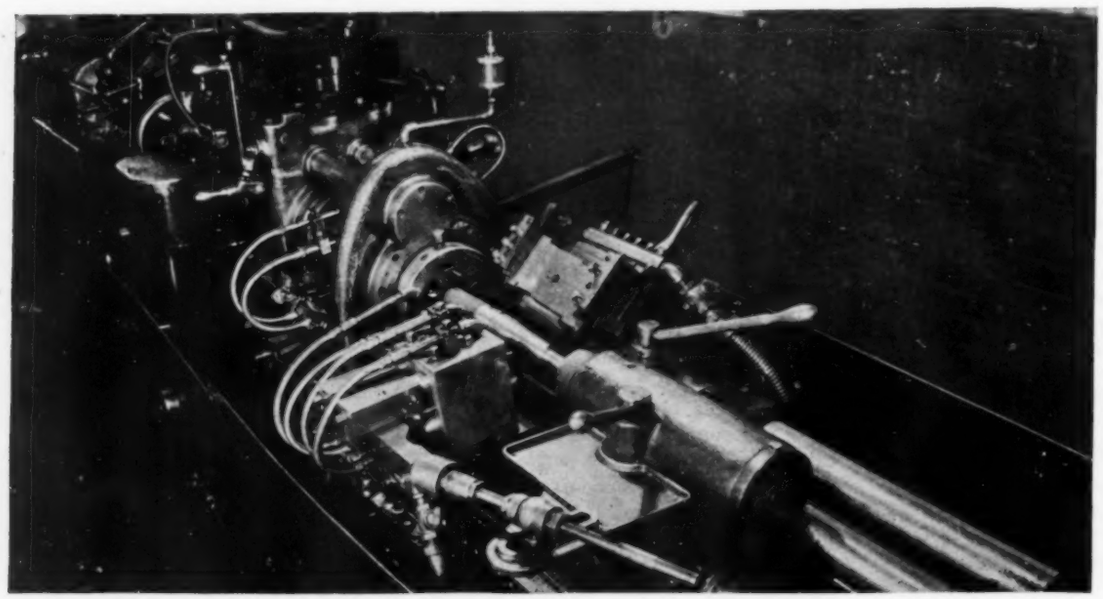

Fig. 2—The taper attachment on a center drive turret lathe may be adjusted to cut a variety of angles

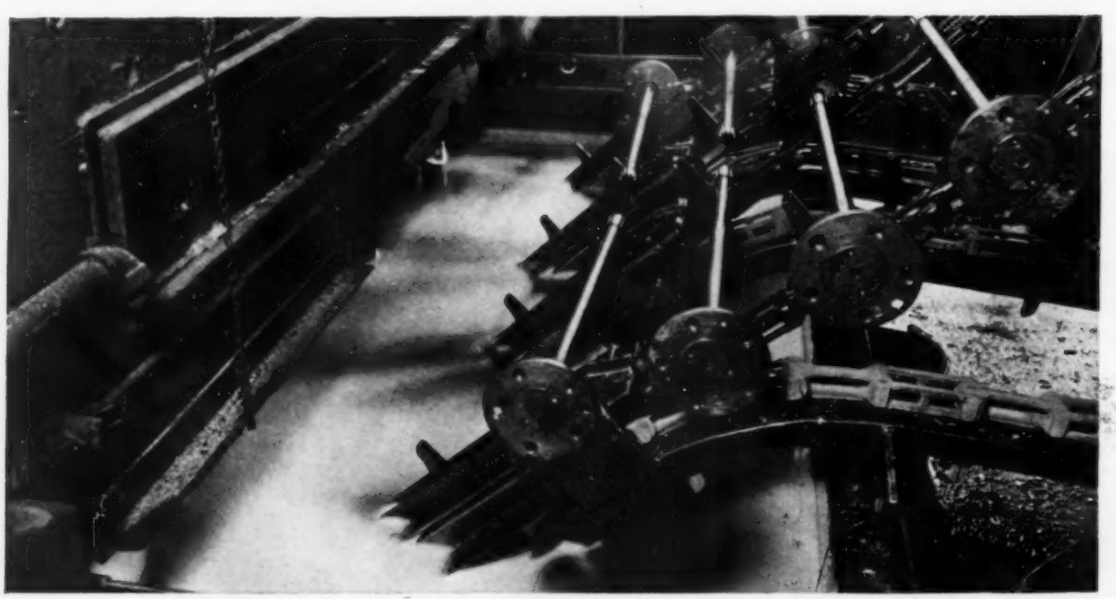

Fig. 3—Shafts of various types are quenched automatically from the heating furnace and then carried into the drawing furnace on a conveyor

performs these operations feeds the shafts into the furnace.

Heat-treating is fully automatic. Work passes through two electric furnaces with recording temperature controls; since these units are made wide enough to accommodate propeller shafts, two axle-shafts may be placed in them side by side. The work is first carried through a Volta heating furnace which brings it above the critical temperature. A horizontal furnace conveyor delivers the work to a vertical air-operated elevator at the discharge end which lowers the shaft to a point a few inches above the surface of the quenching oil and then dumps it for quick cooling. Shafts are removed from the tank by means of an inclined conveyor which carries them into a General Electric drawing furnace heated to 800 deg. They emerge at the opposite end with very little scale, and this is removed by hand-stoning, while the work revolves between centers. Every shaft is then given a Brinell test and straightened in an Oilgear press to within 0.005 in. on the surfaces which are to be ground.

Five grinding operations on Landis machines finish the diameters. Six holes in the flange are serrated, two at a time, by push broaches used in a punch press. Then the work is washed by being passed under soda sprays and given a 100 per cent inspection.

The means for handling the propeller shafts affords another example of the way in which McKinnon is set up to perform work of varying dimensions. Tubular type propeller shafts are made of three pieces; a piece of tubing in the center with two steel parts fitted into the ends. The smaller of these parts is made in an automatic screw machine, while that at the front end is a forging machined in a Fay lathe. These two pieces are pressed into the tubes simultaneously in a home-made horizontal hydraulic press.

Welding Propeller Shafts

Both parts are welded in place automatically in an arc-welding machine which supports the work between rolls as illustrated in Fig 4. This apparatus was built at McKinnon's with electrical parts supplied by the General Electric Company. The unusual part of this set-up is that it will accommodate a wide variety of work. Spacing of welding heads, feed of welding wire and rate of rotation of the work are all adjustable to fit the job immediately at hand. One shaft is completed with each revolution.

To test the effectiveness of these shafts, the apparatus illustrated in Fig. 5 is used. A weight of 528 lb. carried on a 2-ft. arm, as shown in this illustration, is used to provide a torsion loading. The shaft is gripped pneumatically at one end, and is held at the other in a socket which rotates with the arm supporting the weight. The shafts can be put in place quickly and loaded by releasing a pneumatic hoist which normally supports the weight. This test has the advantage of checking both the welds and the quality of steel in the tubing. One end of the apparatus slides on ways to accommodate different lengths of propeller shafts and the socket in the opposite ends may be quickly changed to receive various types of shafts.

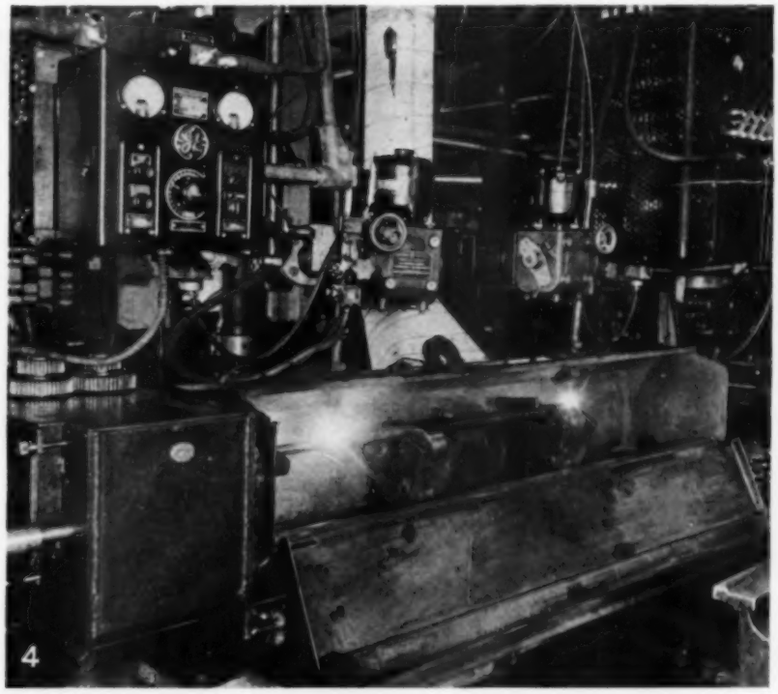

Fig. 4—This automatic arc welder may be adapted to handle a wide variety of propeller shafts

Fig. 5—After welding, propeller shafts are loaded in torsion, which checks both the tube and the weld

Scraping

A DECLINING ART

FRED B. JACOBS

Fig. 1—After grinding, the scraper is held vertically and the edge is honed

Fig. 2—Typical scraping procedure is exemplified by the operations on a machine frame

THERE IS nothing new about the art of scraping metal surfaces to form true bearings and absolute planes, as this practice antedates the machine tool industry itself.

The art of making surface plates in lots of three, each plate to correct the errors in the other two, is an old one. Sometimes it is credited to Joseph Whitworth; in all probability it was known before Whitworth's time, although we must give him due credit for perfecting accurate measuring and testing processes. As a matter of history, it is claimed that the three-plate process was used in Henry Maudslay's shops before Whitworth's time.

Be that as it may, scraping is one of the oldest of machine building processes, and it is one of the few mechanical operations that have not undergone radical change with advancement of the machinist's trade. Scraping today is relied upon to generate true planes; the methods followed are the same as those used by our great-grandfathers. To be sure, scraping machines have been introduced, but their use is not common.

Today, accurate scraping is almost a lost art except as practiced by machine tool builders. In such plants, scraping is done with a high degree of perfection, generally by men who have devoted a lifetime to this particular class of work. This article illustrates the methods followed at the plant of the National Acme Company, where scraping is relied upon for accurate finishing, principally of tool slides, although a few other surfaces are finished by scraping also.

Proportions of scraping tools vary greatly with individual users. Some machinists prefer long slender scrapers; others favor shorter tools with no

flexibility. In general, the average scraper is about 16-in. long, handle and all, 1-in. wide and $\frac{3}{16}$-in. thick, tapering down to $\frac{1}{8}$-in. at the cutting edge. These scrapers often are made from old files, as such tools are nearly always made of high grade steel. Other machinists prefer scrapers made from high grade flat tool steel stock.

Heat-treatment plays a large part in the proper performances of any scraping tool. In general it can be said that heating to a full cherry red, quenching in brine and drawing to a medium straw color will give the correct temper. The tool must be hard enough to hold its edge for a reasonable time, but if it is too hard the cutting edges will chip and cause scratches.

The way in which a scraper is ground and honed has much to do with its effective use. The sides near the point are ground smooth to remove all scratches. Then the bottom is ground square with the sides. No two machinists hone a scraper exactly alike, but the machinist shown in Fig. 1 has been scraping machine tool components for some 40 years and, therefore, has had the benefit of considerable experience. He holds the scraper upright as shown and in this position passes it back and forth across the hone or stone with the flat face toward him, but at a slight angle, from 5 to 10 deg. After the bottom of the tool is honed, he hones the sides slightly to remove any burrs. The stone or hone used is manufactured alumina, 8x2x1 in. The size is not arbitrary by any means, but the grit should be medium.

Before any scraping operations are done on a machine frame it must be leveled carefully on the floor. The machine shown in Fig. 2 was set so that the engineer's level shown at *A* gave a true reading when the surface was tested with the level in its present position and at right angles to this setting. The same test was made on surfaces *B*, *C*, *D* and *E*. The machine is leveled by placing tapered wedges under the base.

The scraping operation shown in Fig. 2 consists of generating flat surfaces for the spindle carrier casing. Both ways are scraped to the surface plate shown at *F*. The bottom of the spindle carrier casing also must be scraped to a bearing. Thus, if the contacting surfaces are true bearings, the spindle carrier casing will not be sprung when it is bolted securely in place.

Despite improved accuracy in metal-cutting machines, use of the scraper is frequently made in order to improve surface bearing and appearance

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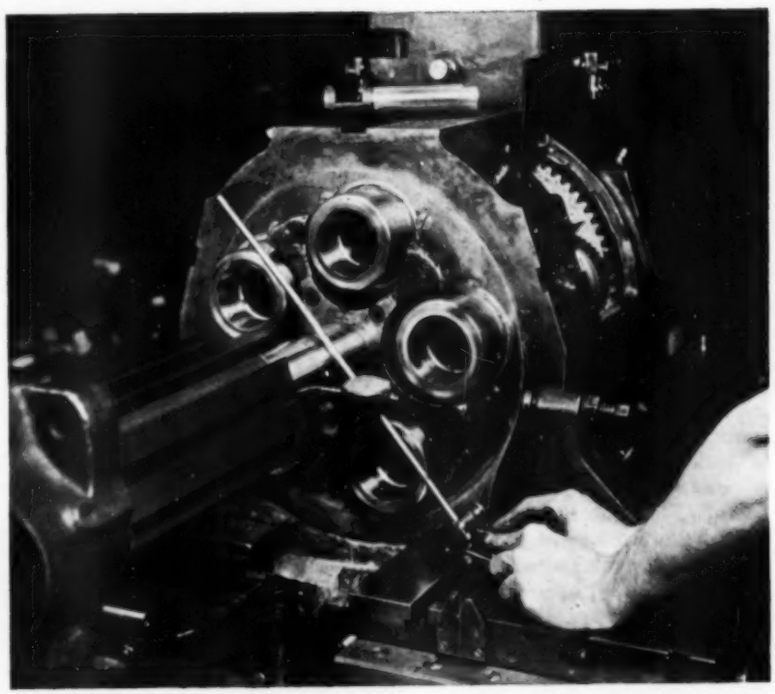


Fig. 3—A dial indicator held against the spindle carrier stem checks accuracy of alignments

Fig. 4—An air hose conveniently near at hand clears away the chips

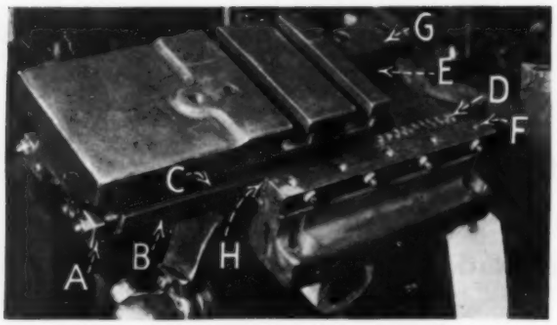


Fig. 5—Many scraped surfaces contribute to precise fit in a screw machine slide

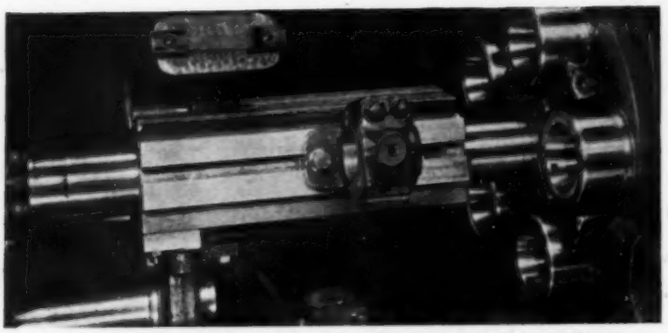


Fig. 7—Tool holders are scraped to avoid spring when they are clamped in place

This scraping operation is to get a bearing only; no extra time is spent in ornamenting the surfaces as they are hidden after the casing is put in place.

The bottoms of the ways for the cross slides are scraped to true planes, the surface plate shown at *G* being used to get the bearings. The vertical bearing surfaces are scraped to a straight-edge because any light showing through indicates lack of flatness.

It is essential that these slides stand exactly square with the spindle axis, and after the machine is partly assembled the test, shown in Fig. 3, is carried out to prove the accuracy of the work. A dial indicator is mounted on a surface gage and brought to bear against the spindle carrier stem. Plugs in the surface gage base bear against the T-slot in the tool slide. This T-slot is exactly square with the tool slide ways, this having been proved in a previous test. By moving the indicator back and forth, with the dial plunger bearing against the spindle carrier stem, there should be no variation in the reading. If there is a slight variation, the error is overcome by rescraping the slide at *H*, Fig. 2.

In performing various scraping operations, it is necessary to provide a large number of surface plates, many of them of special design. When not in use, these plates are kept in a cabinet provided for the purpose. Constant use of these plates is bound to result in slight wear and to avoid errors caused by wear, each plate is tested at frequent intervals on the 10x30 in. Brown & Sharpe master plate shown on the bench in Fig. 4. If upon testing, the plate gives a true reading it is returned as satisfactory. If it is worn slightly it is repaired by scraping as shown in Fig. 4. The plate in process of scraping is a special unit, the slot being provided for clearance.

Fig. 4 also shows the correct angle at which to hold the scraper, which is about 30 deg. from the work. Of course, 30 deg. is not arbitrary, as the angle will vary slightly with different operators. However, by referring to Fig. 4 and again to Fig. 2 it will be noticed that in each instance the angle is about the same. These illustrations show that each man holds his scraper practically in the same manner, down with the left hand and pushing it with the right hand. These two machinists are men of long experience, each of whom learned his trade abroad under different conditions. The fact that they handle their scrapers in a similar manner would tend to prove that a good mechanic naturally uses his hands in the most favorable position to bring about certain results.

Again referring to Fig. 4, it is shown that the bench is equipped with an air-line handy for blowing away chips before testing with a surface plate. All the individual benches at the National Acme plant are thus equipped.

In Fig. 5 is shown the type of lower tool slide and base used on a 1⅝-in. Acme-Gridley automatic screw machine. Considerable scraping is involved in fitting this slide properly to its base. This slide is fitted with two hardened and ground steel gibs shown at *A*. The surfaces on the under side of the slide where these gibs bear, are finished by grinding. In many cases the surfaces thus finished are accurate and flat enough without the necessity of scraping. However, sometimes it is necessary to scrape these surfaces slightly.

The slide is scraped at the sides, as at *B*, and at the top of the slide bearing, as at *C*. The bottom of the slide base is scraped at *D* and *E*, also at the top at *F*. It is necessary to scrape at *F* to insure that the caps, one of which is shown at *G*, will fit properly. The bronze gib *H* is scraped on one side. When the slide is fitted accurately by scraping a feeler gage 0.001 in. thick cannot be forced between the bearing surfaces.

It is, of course, necessary that the sides of the slide be perfectly parallel. This is determined by using the special beam caliper shown in Fig. 6.

Fig. 6—A special beam caliper helps the inspector check for size and squareness

If a slight error is evident it is measured by means of a feeler gage and the slide is rescraped to overcome it.

The parts shown on the tool slide in Fig. 7 are toolholders. The slots in the tool block are finished accurately by grinding, as are also the bearing surfaces against which the toolholders are clamped. The bottoms of the toolholders are scraped accurately to make sure that they are flat. If they varied slightly from a true plane they would, of course, be sprung when clamped down by the two bolts used to hold them in place. As the tool holders are provided with tongues, these parts are scraped on a surface plate provided with a groove, as shown in Fig. 4.

No special pains are taken to ornament highly surfaces which do not show to any extent in the finished machine. After they are scraped to secure a good bearing they are "frosted." In this type of ornamental scraping, spots are scraped on the surface one after another to present a pleasing appearance.

In cases where the finished surfaces occupy a conspicuous place on the machine they are ornamented with special care. Ornamental scraping is an art in itself, and no two men perform this kind of work in exactly the same way. Thus their work varies in characteristics just as the hand-writing of different individuals vary. Ornamental scraping is a manual operation calling for some artistic ability.

Fig. 8 shows a good example of this work, wherein the entire scraped surfaces are covered with crescents. This is a popular design, and it is astonishing to note how rapidly a skilled workman will ornament a comparatively large surface.

It is impossible to explain in absolute detail just how this type of scraping is accomplished. However, a good idea can be obtained by referring to Fig. 9. The machinist holds the scraper below the handle with both hands, the handle resting against his chest. In this position, he rocks the scraper and at the same time pulls it toward him.

The result is a line of crescents. Thus by rocking the scraper from one edge he makes crescents, but some men rock the scraper from the center and thus scrape a chain-like design.

The time necessary to scrape an accurate surface depends on a number of factors. First, must be considered the accuracy of the part as it is machined. If it is out of plane 0.002 in. at two corners, then approximately 0.003 in. must be removed from the entire surface to generate a true plane. The nature of the machining operation has something to do with the time required to scrape a satisfactory surface. Parts finished by planing are scraped readily as considerable loose iron must be removed; as this is scraped away, inaccuracies in the plane are corrected.

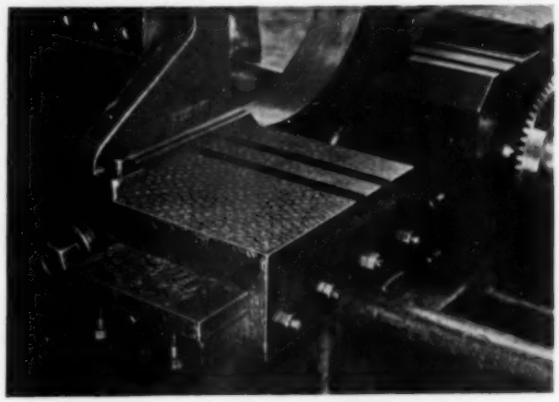


Fig. 8—Parts that show up prominently are carefully spotted with crescent or other designs

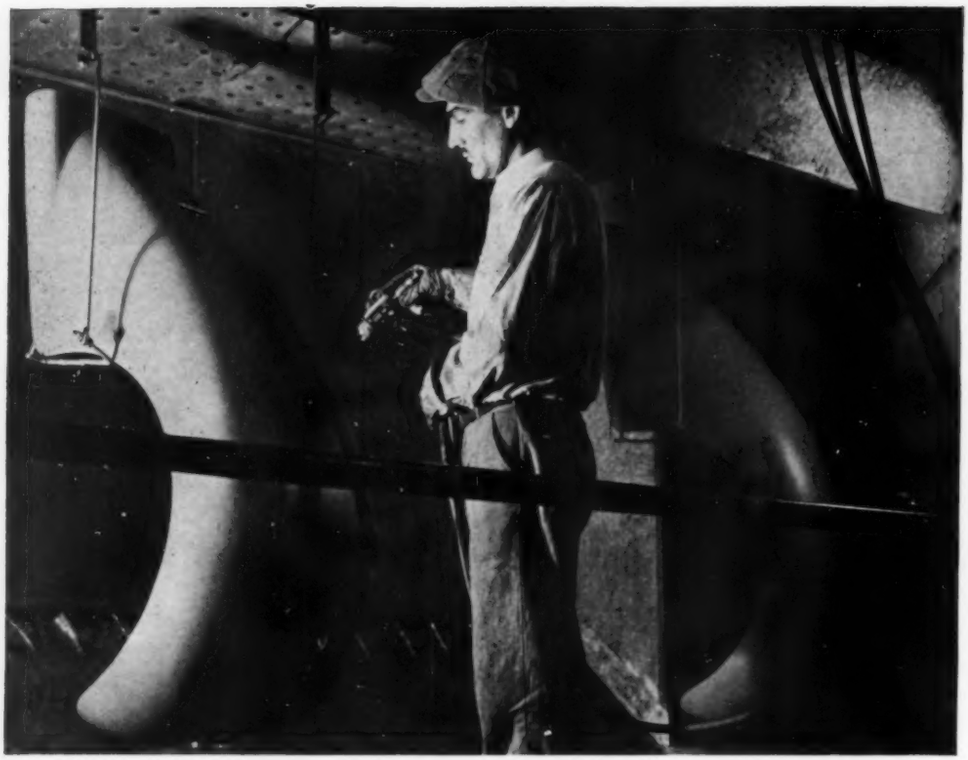
Fig. 9—The technique of spotting varies with the craftsman but is usually done by pulling and rocking the scraper simultaneously

Milled surfaces are not scraped as readily as planed ones, that is not until the scraper has penetrated the surface to a slight extent. Ground surfaces are the hardest to scrape as they are comparatively smooth and thus do not afford an opportunity to get under the surface.

The skill of the machinist has much to do with the time necessary to finish a given surface. Each time he spots his work with his surface plate, he knows where to remove metal to advantage even where it does not show up as a high spot. If he simply scraped away each high spot one at a time, paying no attention to the surrounding metal, the labor cost would be excessive.

With the accurate machine tools of today at hand, why is it necessary to scrape surfaces to obtain true bearings? This question often is considered by production engineers. The answer is that in spite of the perfection attained in machine tool construction it is impossible to plane, mill, or even grind a surface to an absolute plane. Slight errors will be in evidence when the work is spotted on a surface plate. The error may be less than 0.0005 in., but it is there.

Thus the art of scraping will probably be followed for many years to come, especially in machine tool building where accurate surfaces are absolutely necessary to insure the built-in precision of finished machines. Scraping is an art requiring considerable patience and practice, and this may be the reason why the majority of machinists who are doing scraping today are middle aged.



Courtesy Chrysler Corporation

You don't hitch polo ponies to lumber trucks

THE COLLEGE CROP

CLEMENT J. FREUND

Dean, College of Engineering
University of Detroit

THIS YEAR engineering college graduates will not tend filling stations or peddle vacuum cleaners; they're going to work in industry. There are probably half a dozen of this year's crop right out in your plant.

You may have a little trouble with them; it's perfectly natural. The boy reports to a man who worked his way up from the bottom, or an engineer long enough out of college to discover that the graduates of today are a sorry lot compared with the superior young fellows of his day. The boy is nervous, and there is tension from the start. After a week or two, sharp words are exchanged and tempers explode. The lad departs, bitterly charging prejudice, and the superintendent declares that college kids have always been a nuisance and vows to experiment with no more of them.

The difficulty is probably that employers don't know enough about the college graduates to handle them properly, and it is not the employers' fault. College officials have made little effort to tell them what the young graduates are like, and the boys have not done it themselves, probably because they didn't know how.

I shall write no long dissertation on the characteristics of the college graduate, but perhaps I can suggest what type of work you can expect him to do. This does not apply, of course, to the young man who has had exceptional experience of one kind or another. And it refers especially to first or beginning jobs.

Try the following:

1. Drafting, testing, experiment, engineering, any task involving the use of instruments and measuring devices.

This sort of thing is in line with what he has been doing in his laboratory courses; he enjoys it and feels sure of himself.

2. Investigation of technical operating, management, various problems.

Such assignments challenge the best there is in him. A young graduate in a Milwaukee plant was told to determine the reasons for failure of metals in service. He soon accumulated much exceedingly useful information and is today the head of a metallurgical department.

3. Personal assistant to corporation officer, engineer, chief draftsman, production manager, superintendent.

Many an overworked official or department head needs a good Man Friday to take charge of his office, watch the telephone, follow up projects, get information, work up masses of data into intelligible reports, run the better type of errands, keep an eye on the calendar. The alert graduate is your man.

Courtesy Chrysler Corporation

Such assignments challenge the best there is in him

4. Any kind of work in which college training can be directly or indirectly applied.

In the back of his mind, the college graduate constantly challenges his education to justify itself. Whenever he does anything which he learned to do specifically in college, like surveying, he thinks he is getting dividends on his educational investment. His attitude is wrong, but he has it and you might as well take it into account.

5. College apprentice courses, sales training programs, understudying somebody, jobs in newly organized departments.

The boy's uncle, or his father's best friend, has probably insisted right along that a college education is a waste of good money: "Put the kid to work early." The young man feels it is up to him to get quick results or he and his parents will have to listen to a lot of "I told you so." The regular little promotions of the training course and the expanding responsibilities of the new department will keep the uncle quiet and the boy happy.

College graduates have other possibilities, but most of them doubtless start best on such jobs as I have listed.

Avoid the following, unless they are clearly the way to something better:

1. Punch press, machine molding, repetitive piecework, routine copying or entering, tracing.

This is obvious. Monotonous tasks are unsuited to the high-strung college temperament. You don't hitch polo ponies to lumber trucks.

2. Highly difficult and complex design, research, estimating, calculating, production control.

Much berated otherwise, the college graduate gets too much credit for technical skill. One of our graduates told us he was to be fired because "he couldn't do thermodynamics." We investigated. A difficult problem had stumped all the best engineers in the corporation where the boy worked. "Here comes a young fellow right from college; he can do it," they said, and they really thought he could. But he couldn't—and could not be expected to. A course in engineering should lay a good foundation, but it does not confer full professional competence.

3. Routine work in shipping or receiving departments, inspection in a small or highly specialized department, handling in a detached warehouse, helping a contented and permanently fixed chemist, anything with no future.

Related to No. 1, above.

4. Riding your hobby.

Almost every business man has some pet enthusiasm or other to which he gives much thought and attention, leaving other matters to associates or subordinates. One man thinks motion study makes the world go around, another costs, another well written letters, another shrewd buying, another efficient power production, and so on. There may be a million employers in the United States, and nearly that many hobbies. You can't teach a boy a million hobbies in a four or five year engineering course, not even in a good college. It may be that the graduate has never even heard of your hobby. But he will learn if you tell him.

Be patient with the college boys. They start slowly and awkwardly, but most of them soon become extremely valuable. I need not prove that, it's in the record.

And if the young man fresh from college takes a job it does not necessarily mean that he likes it or will fit into it. He must eat, like the rest of us, and when he needs to eat badly enough he will work at anything.

TODAY'S Machine Tool Problems

SOL EINSTEIN

Cincinnati Milling and Cincinnati Grinders, Incorporated

Diversification, specialization and demands for greater precision have created a new set of conditions which the maker of metal-working equipment must face today

PICTURE for yourself the conventional machine shop when the old timers of today got started in the engineering profession. Then, one would see such old friends as the planer and shaper, the engine lathe, the drill press and radial drill, the knee and column type milling machine and the Lincoln-type miller, a few universal grinders and some tool grinders. These machines constituted the normal equipment. Instead of grinding machines there were a few speed lathes, and for gear-cutting there were milling machines with index heads, or some other primitive gear-cutting apparatus.

The operators were almost exclusively trained mechanics capable of operating any machine in the shop. Each selected speeds and feeds to the best of his knowledge and used the squirt can generously, meanwhile operating the machine carefully to avoid spoiling the work. Frequently, the machinist would have an apprentice standing next to him to be initiated into the secrets of the trade. Parts were produced from drawings, but tolerances and fits were left to the skill and judgment of the operator.

Changed Conditions

In great contrast to the old-time shop we find today an undreamed of variety of standardized, semi-special and special machine tools in modern shops. The operators serving these machines are not generally all-around mechanics, but specialists who handle the particular type of machine involved. Often they are trained to produce only a particular work piece. The shop itself is divided into various functional elements and departments, sometimes grouped as to similar operations and in other cases into line production units. It is to these greatly changed conditions that the machine tool manufacturer must now build his product.

For the toolroom the machines must be designed for producing a great variety of work, usually single pieces of any shape or size. Thus, the machines must be universally applicable and operable under extreme range conditions. Modern toolroom equipment with its liberal slide dimensions, its rigid frames and its ease of operation fulfills all accuracy demands of modern industry. That such modern equipment sometimes does not perform even more favorably in regard to time-saving as compared with older models is because too much time is spent in chucking the work piece. Standardized chucking and clamping equipment for toolroom operations would minimize setting-up time, and the full benefit could be obtained as from modern manufacturing equipment.

Toolroom Antiquities

Replacement of toolroom equipment has not been in line with the replacement of manufacturing equipment, according to the *American Machinist* 1935 Inventory of Metal-Working Equipment (Vol. 79, No. 9). This analysis shows that 75 per cent of toolroom-type machinery is more than ten years old, whereas for metal-working equipment in general the figure is 65 per cent. The large amount of energy and ingenuity that the machine tool builder has put into the development of toolroom equipment should be met with more response and cooperation from the user toward full utilization of its productivity.

Unquestionably the years of the depression have retarded the replacement of production equipment. The *American Machinist* inventory referred to states that in 1935 the equipment was 65 per cent over ten years old, having increased from 48 per cent in 1930 and 44 per cent in 1925. It can be positively stated, however, that development of production tools has not stood still during the depression, but on the other hand has been very active.

Machines in Demand

Design and manufacture of production equipment is one of the biggest problems of the machine tool builder today. He is required to build machines for the toolroom which are also frequently used for small-quantity manufacturing. Ease of manipulation and setting-up of such machines make them especially suitable for this class of work. He is further required to build machines for quantity manufacture of medium or high production, but such machines must be different from the general utility machines. They should have a semi- or completely automatic cycle, and the work of the operator should be confined to the chucking and unchucking of the work.

Besides these two types of machines, which are normally standard and which can be produced on a quantity manufacturing basis, the machine tool builder is asked to build high-production machines of a semi-standard nature; that is, machines which are partly made of standard units and partly of special mechanisms to meet individual requirements. He must also build high-production, semi-special tools, which are machines of special design using a few standard components. Finally, he is occasionally required to meet a demand for completely special machines.

The demand for these various types

An abstract of a paper presented before the Machine Shop Section of the American Society of Mechanical Engineers, during the Semi-Annual Meeting, held in Cincinnati, June 17-21.

of machines did not develop in the order mentioned, but on the contrary, jumped from one extreme to the other. When the metal-working industry started to get on a large manufacturing basis, it departed from the standard machine tool and saw its only salvation in the highly specialized machine. But this class of machine has the disadvantage of being designed to produce a specific part only. Consequently, it becomes obsolete as soon as a change in the part takes place. To overcome this situation, standard high-production manufacturing machines were developed. Lately, these have been of the unit-type construction which has made possible the assembly of semi-standard machine tools or semi-special, high-production tools from more or less standardized units. Productivity of these assembled machines compares satisfactorily with the special machines formerly in vogue.

Groups Served

The machine tool manufacturer in any particular line must serve various groups in the industry. One group may deal with small units such as typewriters, sewing and adding machines; a second may produce medium-size products, like the automobile and electric industries; and the third makes large products such as railroad equipment, printing presses and power plant equipment. Thus, even if the machine tool manufacturer confines himself to a limited line of products, he must build machines in a relatively large number of styles and sizes to meet the demands of his customers.

To illustrate to what extent machine tools have been developed, there may be cited more than a dozen types of lathes, some fifteen types of milling machines, and over twenty types of grinding machines produced today in this country by various manufacturers. Practically all of these various types are built in a range of sizes. Every year brings new machines on the market, and new methods and applications add constantly to this large list. The life of an individual design has become shorter and shorter which results in the costly problem of keeping machine tools up-to-date.

Another serious problem which the machine tool builder faces indirectly is the improper care of machine tools in a large number of shops. It is astonishing how little care is taken on the part of the operator and shop management to keep these machines clean and thus maintain the intended accuracy and avoid break-downs. Adjustments of tool and work supports are occasionally required, and are provided in most machines. Too often they are utilized only after damage to the tool or work.

The machine tool manufacturer is today the consulting engineer of industry in its various tooling problems. Because of the extreme specialization of the modern machine tools, the production department of an industrial plant will send the part or a drawing to various machine tool manufacturers and ask for recommendations for the best method of machining. Thus, industry obtains expert opinion on its production problems as free service. This service requires not only a thorough study of the individual operations involved, but also comparative time studies of all possible methods, consideration of fixture and tool problems, and in a large number of cases a study of the piece as to its resistance against strain and behavior during and after cutting. Selection of the cutting tool material and of the clamping and holding arrangements also require considerable study. In addition, the average industrial designer may not have kept himself fully versed in the development of new methods and new machines with the result that the work must frequently be produced by a less advanced method.

Modern Tolerances

In every modern shop there is an elaborate system of tolerances for the various fits, and considerable attention is paid to the desired surface finish. What has taken place in the tightening up of tolerances is best illustrated through a practical example. When the centerless grinder was first introduced, tolerances of piston pins were one-half thousandth of an inch. The possibilities of the machine caused automobile manufacturers to reduce these tolerances, first to one-quarter thousandth and four or five years ago to one ten-thousandth. Today piston pins are lapped on a centerless lapping machine at a rate of 30 to 40 per min., and with a tolerance of one-quarter of one ten-thousandth as to roundness, and a tolerance of one-half of one ten-thousandth of an inch as to straightness and size. Simultaneously with this tightening of tolerances has come a demand for better control of surface finishes. Various standardization committees, sponsored by the A.S.M.E. and other national societies, are working toward the standardization of surface finishes and means to determine and to inspect such surfaces. When these standards are established, they will no doubt put an additional burden and problems up to the machine tool manufacturer.

Standardization of machine tools and machine tool elements is an intricate problem. Fear of obsolescence of some of their products on the part of the machine tool manufacturers and the diversified demands on the part of the users are but some of the difficulties which have to be overcome before such standardization may proceed. Even the secondary elements such as spindle noses and other tool or work receiving elements have not been standardized.

Research Required

Progress in the art of cutting metals is slow, despite the fact that high-speed steel has been known for 30 years. It is frequently the experience of every machine tool manufacturer that a change of cutting or rake angles or changes in the design of the tool will materially improve the functioning of the machine, increase its production, improve the finish of the work piece, and prolong the life of the cutting edge of the tool. When we experience such results, it is quite natural to expect that our troubles with the newer cutting materials will be multiplied many times. This is due in part, at least, to the fact that today we have a very meager knowledge of what takes place at the cutting edge of a tool. Excellent research work under varied conditions has been made and published. While these tests have contributed much to our practical knowledge, it is safe to say that millions of dollars annually could be saved if we could get a thorough knowledge of what takes place when a chip is produced and of the conditions under which we could produce this chip most efficiently.

These problems cannot possibly be solved by an individual machine tool builder or by the machine tool industry at large, nor can they be solved solely by research work of university laboratories. Ultimate results can only be obtained by united effort on the part of the machine tool industry, the laboratory worker, and metal-working industry at large. A committee representing the three groups should be established to develop a plan for research. A report of the probable costs should then be presented to men of influence in industry for the purpose of obtaining funds to proceed with the research program. Only concerted action can bring about the savings predicted.

DIESELS in the CUMMINS PLANT

FRED H. COLVIN
Editor, American Machinist

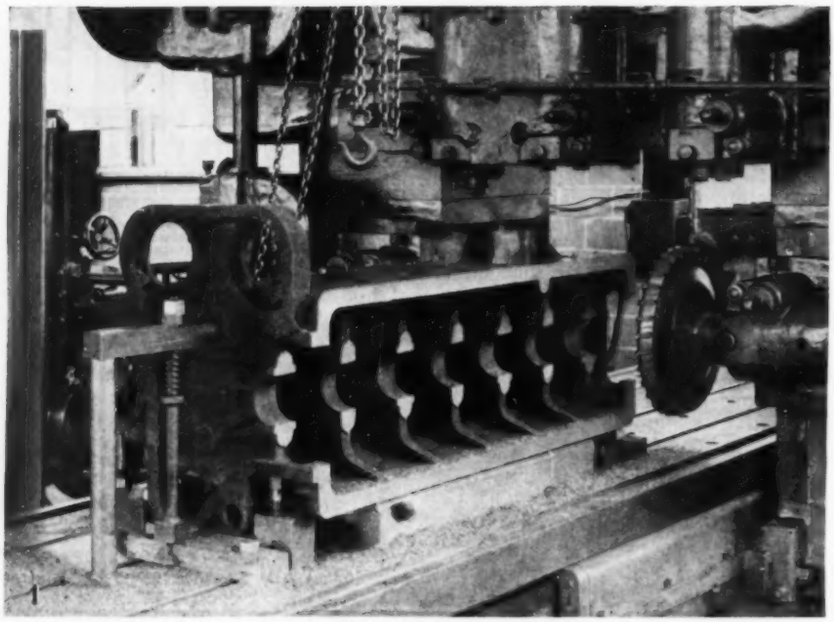


Fig. 1—Top and bottom of the block are milled simultaneously by the side heads

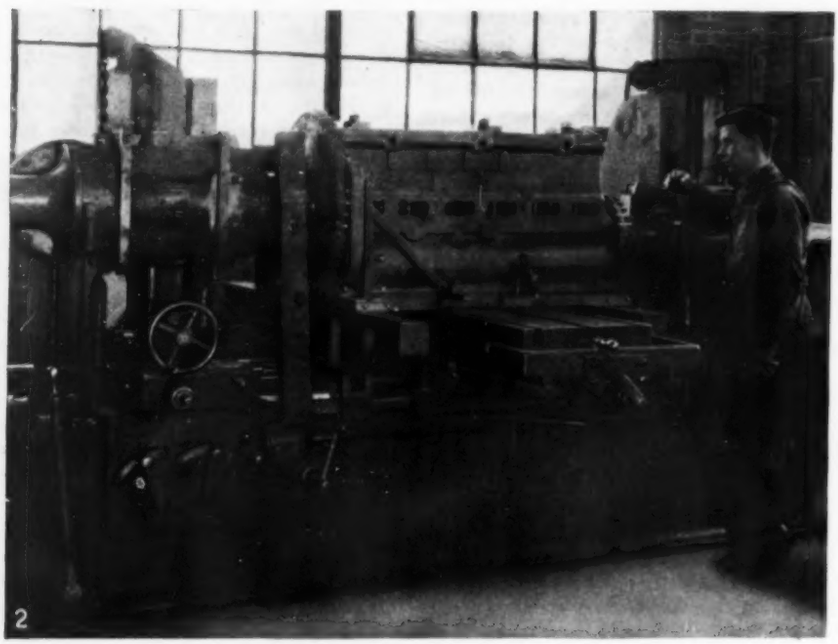


Fig. 2—Extra bracing is required to adequately support the ends of the block

PREPONDERANT production of gasoline driven automobiles tends to make us overlook the growing use of diesel engines in trucks, tractors, portable power plants and in railway and marine work. For, while their number is small in comparison with the output of spark ignition motors, it is much larger than many realize. Evidence of this is clearly shown by a visit to the new shop of the Cummins Engine Company, the result of eighteen years of experience and growth. Incidentally a racing automobile powered with a Cummins diesel engine made the first and only non-stop run at the 500 mile race at the Indianapolis Speedway, in 1931, at a total cost for fuel and lubricating oil of $1.78. On March 2nd, 1935, the same car set a world's Diesel speed record of 137.195 m.p.h. It is also of interest that one truck fleet has nearly 90 of these engines, averaging over 100,000 miles each, per year, indicating the steady growth of this type of engine.

Three Milling Cutters Used

Cummins engines are built in a number of sizes and powers to suit varying conditions. As with other diesel engines the cylinder itself is a liner which fits into the cylinder block and has its outer surface cooled by the water that fills the jacket. The cylinder block is machined in much the same way as other engines built in the same quantity. Both top and bottom of the block are milled as in Fig. 1; the two vertical milling heads are not used in this operation. The large face mill is replaced by a smaller cutter for facing the seats for the bearing caps. The clamping of the end of the block shows a convenient method of holding the bolt so that it and the clamp can

C. L. Cummins, president of the Cummins Engine Company, recently made the 1200-mile trip between New York and Chicago with a total fuel cost of $2.21 in one of the first passenger cars in the United States to be equipped with a diesel type engine

be easily moved out of the way for loading and unloading. Two screw jacks at the end take the thrust set up by the clamping bolt. The cutter that is milling the top is hidden by the block itself.

The ends are milled on a horizontal boring machine, Fig. 2, that is a bit small for the large face mill at the left. On this account extra clamps are used to tie the saddle to the column, and a brake is put on a pulley just behind the face mill. Similar saddle clamps are used on the head at the other end. The fixture has a substantial brace to support the rim of the gear case against the thrust of the large face mill.

Blocks Mounted on Bases for Drilling

Drilling for bearing cap studs and bolt holes is done under a line of multiple drilling machines, Fig. 3. Plate drill jigs are used, and the work progresses from one to the other. After the bottom holes are drilled under the first two machines, the block is reversed and put on bases which can be moved from one machine to the next on the round rails shown between the machine bases. Tapping for studs is also done on this line.

Fig. 4—Either four- or six-cylinder blocks may be bored and counter-bored in one set-up

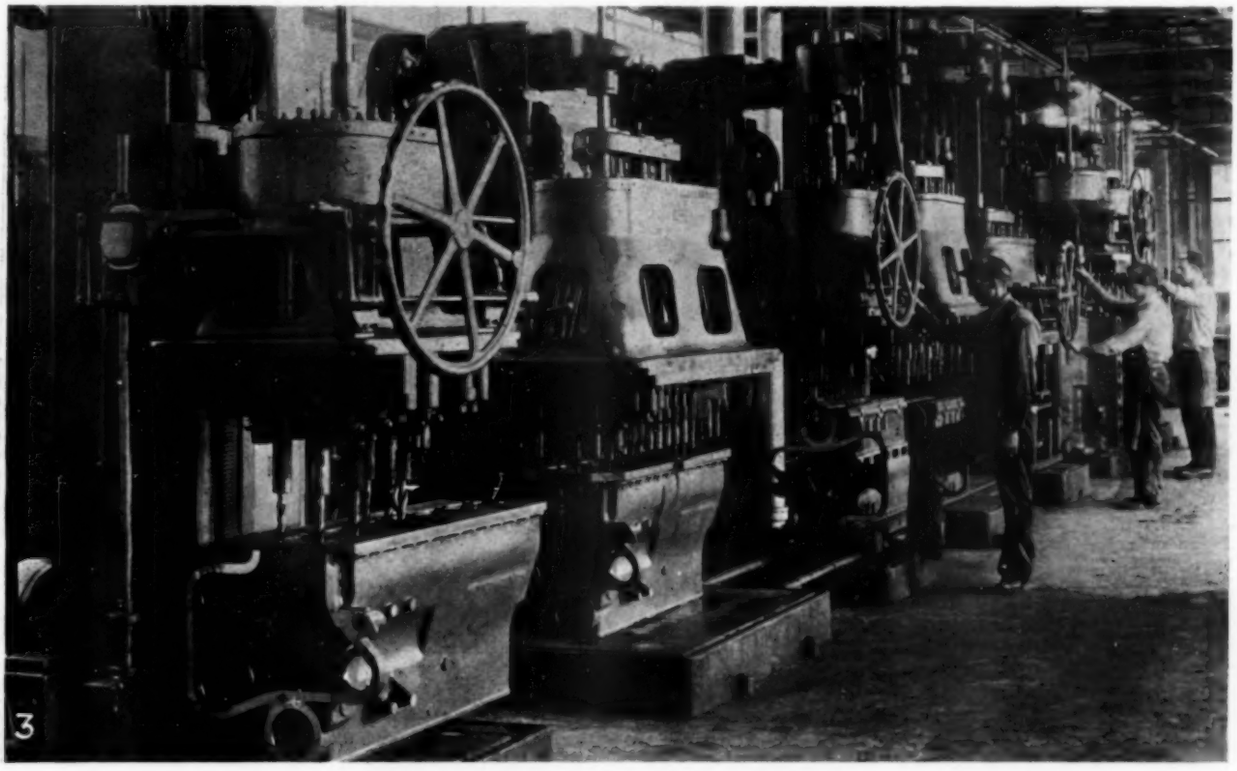


Fig. 3—First the bottom, then the top is drilled and tapped in a battery of multi-spindle machines

The cylinder blocks are bored in the multiple spindle machine in Fig. 4. Although shown at work with six spindles, the same machine is used for four cylinder engines by moving the two end spindles to one side. Each spindle carries a husky inserted blade boring head and, above the boring cutters, are secondary heads that cut the counterbore for the head of the cylinder liner. The depth of the counterbore is held within close limits by the use of the dial indicator shown in the corner just in front of the right hand boring bar. Cylinder sleeves are also bored in this machine by using a suitable fixture and different boring heads.

Large Beds Bored Horizontally

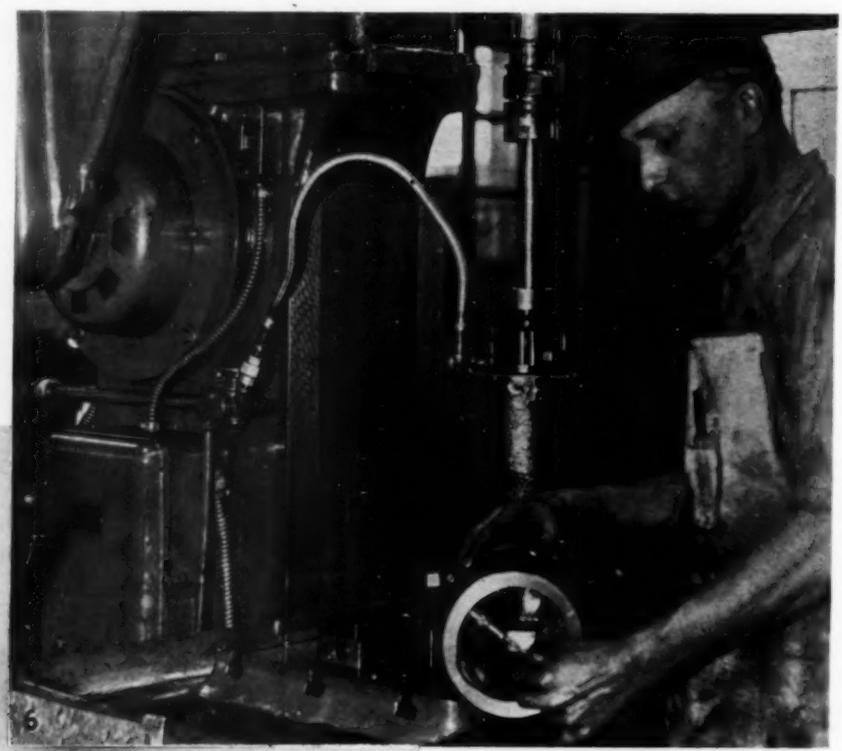
Large engine beds and cylinder blocks are bored horizontally on the floor type machine seen in Fig. 5. The bed shown is one for a small railway locomotive for switching purposes.

Cylinder liners are finished by honing in a single spindle machine as in Fig. 6. The liners are held in a suitable fixture as shown. The diameter is checked by careful measurement with an inside micrometer.

Connecting rods are bored in pairs in a machine of the same general type as that for boring cylinders, using a suitable fixture. The rods are "gun" drilled with an oil hole from the main bearing to the piston pin hole, and the large end is broached together with its cap, as in Fig. 7. The rod and cap are afterward honed on the same machine as the cylinder liners.

In the assembly department small parts are conveniently located in the rack against the wall. The assembling stands bring the motors at a convenient height for getting at the different parts. In general the assembly operations resemble those of any type of internal combustion engine.

Fig. 5—Unusually large beds and blocks are machined in a floor boring machine



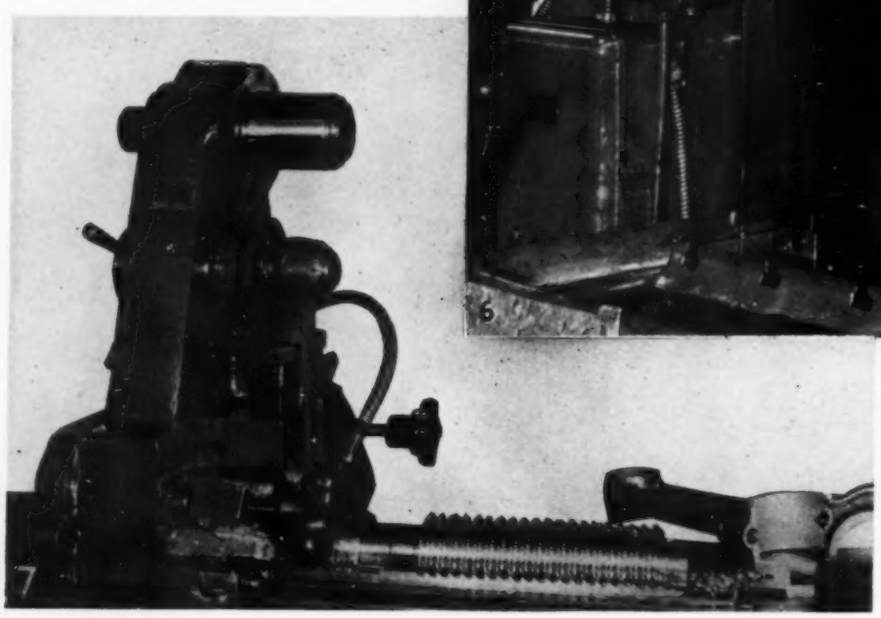


Fig. 6—Liners are bored singly and measured by inside micrometers. Fig. 7—Crankshaft ends of the connecting rods are broached with the caps in place

Better MACHINES and Better PRODUCTS

Photo by Bachrach

A vote of confidence in the future and a step toward higher living standards are combined in the Machine Tool Show, which will open its doors on September 11

◆

HERMAN H. LIND
General Manager
National Machine Tool Builders' Association

HOW DO YOU account for the fact that the Machine Tool Show this fall will be the largest ever held? What are the sources of the advance in machine tool orders? Will sales continue to rise? What about the anti-machine propaganda? These questions are constantly asked by observers outside the machine tool industry of those who are part of it. A complete response to any one of these inquiries answers practically all.

History shows that buyers do not add to their machinery equipment during the depths of a depression. First, they are not able to use the machines they have and, second, they want to conserve cash to "ride through" the uncertainties of a dull period. There are some beautiful exceptions, as some industries have taken advantage of modern tools for cost reduction purposes in order to secure markets, and have obtained their goal through lower priced products; but irrespective of the fact that Andrew Carnegie followed the policy of modernization when business was at its worst, there are not enough such industries to keep the machine tool industry from reaching the very depths.

The industry itself has every confidence in the machine, and the better the machine from cost-saving viewpoint, the more confident the industry is in it. The people of this country have so enjoyed the products of the machine that they are continually demanding more and superior goods; whether these be finer clothing, more select food, more modern automobiles, better radios, in fact, practically anything that can be mentioned. These wants from the barest necessities to the last word in luxuries can be provided only by the utilization of a greater number of superior machines.

With one exception the last eight months have shown an increase in the volume of domestic orders received every month, but the decision to hold the Show was definitely made more than twelve months ago. Therefore, the courage to go forward in the face

of low volume and dearth of inquiries as well as many other retarding influences resulted from confidence in the fundamental place the machine occupies in American life and living. This confidence is further conclusively demonstrated by the development work which the industry carried straight through during the years of minimum business. Practically every manufacturer has re-designed his line, thus making it capable of greater production and finer accuracy with less fatigue for the operator.

Sales Trend Rises

It is this same confidence that the industry has in its machines which causes it to feel that the American machine tool user who sees the latest developments will want to manufacture with the new, modern tools, and thus assure for himself a better product at lower cost with the consequent expanding market. The monthly increase in sales is evident that such a trend is even now definitely under way. Every month reveals a wider range of industries re-equipping. While cognizant of the attacks made on it from a few quarters, the industry possesses the fundamental confidence in the Machine and the Machine Age which compels it to carry the plan forward.

In order to answer the arguments against the machine such as claims of over-production, unemployment, and depressions resulting from the Machine Age, the National Machine Tool Builders' Association has retained the National Industrial Conference Board to make a comprehensive study of all available facts. The material released up to this time indicates a substantial increase in employment as a result of the machine and mass production.

The answer then to most of these questions is the confidence of the industry in its own products. While conditions for doing business have never been ideal and probably never will be, there are now enough instruments in tune to encourage the industry to go forward vigorously. Idle money in the banks is drawing a mere pittance of interest returns, credit is available at low rates of interest. Where can money and credit possibly be put to work with the certainty of safety and return that can be found in the investment and use of modern machinery and equipment? Back of it all is the impelling desire of people to possess more and better things which go to make the higher material standard of living.

What Is the Foreman's Job?

Discussion

W. R. NEEDHAM
Stafford, England

In an article under the title given above (*AM*—Vol. 79, page 43), Frank C. Hudson rightly directs attention to the matter of the foreman and his job. The live foreman who does not make good in his job due, perhaps, to obstructions from above, sees to it that the job shall not let him down. He seeks new pastures where he can make the job, so that in turn the job shall make him.

Successful applicants for jobs, and students beginning their college course are often told, "The future lies entirely in your own hands." That is often very true, and if it were realized, as it might be and as some realize it, a greater measure of success would be obtained by many.

When this writer adds that the foreman's job very largely depends upon himself, he must be understood as meaning what he writes. It is perhaps something of a misfortune that familiarity with such sayings tends to rob them of their essential truth and value. Were it possible to invest the phrase with the novelty of freshness and surprise, it would be brought home that there is something worth while, something of real consequence.

Certainly, it may be accepted as true that, in the majority of cases, where men without influence or substantial backing have risen to prominence, it is because they themselves have made their jobs. By this is meant that the job, whatever it was originally, has become something distinctive that reflects the personality and the impact of the man holding it. Such men are master mariners of their own barques.

Those men who are always ready to blame circumstances for their ill success are generally the victims of their own lack of enterprise. The successful foreman whose success has been earned is a man of tact, initiative, trust, energy and understanding. He is not content to be an echo, no matter how exalted is the man to whom the actual voice belongs.

The foremen who have prospered are men who have definitely made good, particularly when the job as it is now, and as it was before they took it over, might be entirely different ones. The growth of those men has been accompanied by that of the job, and the job itself has grown almost out of recognition. Where their success has found official recognition and they have been promoted, it has depended appreciably upon the reaction of their immediate successors whether the job itself continued on the up grade or gradually declined.

Shop Aids

E. R. SNYDER

To produce a knurl on small work, is possible by means of a file. Use a sharp file of suitable cut, i. e., mill for a straight knurl and cross-cut for diamond. Turning the machine by hand, hold the file on the work and rotate the work slowly. Care must be exercised not to cross the knurl. Of course the file should not be used as a lever.

In order to drill clean cut holes in thin sheet stock, it is easier and safer to use a counterbore, cutting from both sides of the sheet. This also eliminates the burr.

To bend metal tubing to irregular shapes by hand and maintain a uniform cross section throughout, it has been found practical to do as follows: Determine the length of tube required and fill with molten resin, Wood's metal or lead (there are "cold" substitutes, sand, powder, etc.). After pouring allow to cool and bend to required shape. The tube is then heated and the filler drained.

It is possible to temper small tools and dies, if heated to the point of just fusing wire solder and then quenching.

After hardening a piece it often happens that there are minute cracks present which are not evident to the naked eye. If the work is oiled, wiped off and chalked, the oil remaining in the cracks quickly shows up by soaking through the chalk.

Scribers, center punches and other small tools are easily hardened by heating to a cherry red and plunging into a piece of soap.

In order to do a good job of brazing, immerse or thoroughly wet the work in a saturated solution of borax and hot water. While brazing, apply powdered borax freely.

EDITORIALS

VOLUME 79 AMERICAN MACHINIST ESTABLISHED 1877 NUMBER 15
McGRAW-HILL PUBLISHING COMPANY, INC.

K. H. CONDIT • F. H. COLVIN
EDITORS

COMING BACK

THEY are coming back to the shops, the solid, substantial machinists and toolmakers with families to support. When their employers regretfully laid them off because there was nothing whatever for them to do, they turned to driving delivery wagons and trucks, to running hot dog stands and gasoline stations, to clerking in drug stores—to anything that would keep their families in food and shelter.

Until very recently they were firm in their assertions that they were all through with the machinery business. The ups were not high enough to balance the downs, and the downs lasted entirely too long. Many of these men found that they could make more money in a year at the unskilled work of distributing and selling than they could at the higher paid but intermittent jobs in the machinery plants. Even if the new employment was less congenial and quite uninspiring the depression was no time to be fussy about such things.

But the word is getting around that steady work is ahead, that good men are scarce in more than one industrial center, that wages are likely to be better. And the old fascination of fine workmanship and the urge to create are beginning to lure them back.

This tendency is perhaps only a straw in the wind. The number of such men who do come back to their old jobs is likely to be small compared to the needs of the machinery industry. But the mere fact that the tendency exists is a fundamental sign of basic recovery.

As these men come back both they and their employers must be prepared for some troubles at first. A year or two away from close work in a shop almost always costs a man his fine sense of touch that is indispensable to accuracy. It will be hard to recover it, and both sides must be patient while the process of recovery continues.

Furthermore there has been progress in the art even in the last two years. Men who have been away that long will have to learn new methods, unlearn some old ones. Means must be found to make the training period as painless and as short as possible. The experience thus gained will surely prove useful in the much more difficult and extensive training of green men that lies immediately ahead of almost every management in the machinery industry.

They are coming back to the shops. Make it worth their while to stay.

Coordination

TO THOSE leaders of the machinery and metalworking industries who see clearly the continuing need of coordinated action by these industries the vote of the annual meeting of the Machinery and Allied Products Institute to carry on must have been encouraging. Established soon after the enactment of NIRA and of necessity devoting most of its efforts for its first year to the working out of codes, MAPI nevertheless has a bigger and broader field of opportunity.

Not the least of its tasks is the fostering of more than two-thirds of its constituent machinery trade associations which came into being as a direct result of NIRA. Effective trade associations like the National Machine Tool Builders' Association do not spring into being, full-grown, overnight. Their members must learn to know and trust each other, and that is not the work of a few days or weeks. The established associations can take care of themselves and can contribute much to MAPI. The new ones are just as necessary to their respective industries, but the help must come from MAPI until they get on their feet.

Furthermore, as has been so often remarked, the problems of the durable goods industries are a different set of problems from those of manufacturers of consumer goods and from those of merchants. As for the machinery builders their troubles are just an aggravated case of the durable goods industries' disease. They need means of presenting their side of the case in Washington when matters affecting their interests are receiving consideration. Where else can they find a voice than through MAPI?

MAPI can be made better and stronger and more representative of the interests of machinery men. After all, it is a scant two years old. The effort now should be to achieve that improvement because the machinery industries are still far from the degree of recovery that has favored some other groups.

Chips

Washington—New Works Program has proved a failure so far in providing jobs, but FHA modernization program is expected to continue its good work and even better it . . . Work on Passamaquoddy project starts as lobbying charges fly back and forth in Congress . . . Nobody seems to care that the project has been termed impractical by every informed group that has studied it . . . Senate will investigate lobbying by both sides on Utilities Bill, with what is expected to be the usual result . . . Hopkins specifies 8-hour day and 140-hour month for WPA . . . Guffey Bill passage demanded regardless of constitutionality . . . Roosevelt plans speaking tour to disprove ill health rumors . . . House passes Roosevelt's TVA amendments . . . Rumor is that final passage of tax bill may wait until special session in the fall.

Foreign—War between Italy and Ethiopia seems inevitable as every effort to adjust differences ends in failure . . . Britain's attempt to enlist French aid in blocking Mussolini leads nowhere and serves only to widen the breach between her and France . . . U. S. citizens warned to leave Ethiopia . . . British-German naval agreement forces Scandinavia to abandon disarming policy and plan larger navies . . . Germans announce building program including two battleships, two cruisers and 28 submarines . . . French counter with 35,000-ton battleships . . . Naval race is well started . . . Cuba deports American liberals as trouble makers . . . Japan's aggressive tactics in Far East worry both China and the Soviets . . . Austria votes return of Hapsburgs . . . Floods in China reach proportions of major catastrophe . . . Bumper crops in Russia lead to hopes for better food for all . . . British employment at new post-war high . . . Soviets plan to rebuild Moscow, three times larger, within ten years.

Finance—Half-billion federal note issue over-subscribed five times . . . Loans to big business by RFC drop below $1,400,000,000 as repayments increase, while loans to farmers and house owners through HOLC, Federal Land Bank and Farm Mortgage Corp. rise to $5,450,000,000.

Industry—André Citröen, leading industrialist of France, dies in Paris . . . Signing of Wagner Labor Bill clears the way for judicial interpretation of its constitutionality . . . Test case expected soon . . . Ousted non-union workers in New York State knitting mill picket mill and roads to prevent employment of union members from outside the community . . . Premier Baldwin of Great Britain says that U. S. public works program has failed to relieve unemployment . . . General Electric moves all air conditioning equipment manufacture to Bloomfield works.

Trade—Roosevelt proclaims Swedish trade treaty signed May 25 . . . In force on August 5 . . . May imports exceeded exports for second successive month . . . Australian trade treaty expected to follow visit to Washington of Premier Lyons.

Indicators—Steel production turns sharply upward . . . Electric power output makes new high since 1929 . . . Business Week's index rises to 64.1 and exceeds 1934 figure for first time.

Business Balks at Roosevelt Tax Plan; Five Resign From Advisory Council

WASHINGTON—A little study of the Roosevelt tax plan has convinced business men generally that it is one of the most potent sources of damage to business that has yet been advanced by an administration which is coming to be considered as definitely opposed to business recovery. As a result business support of the utilities in their fight against the holding company "death sentence" clause is stiffening. This fight is a local skirmish but it is indicative of the growing determination of leading business men, North and South, to beat Roosevelt at any cost.

Now that the Utilities Bill is in conference those who saw their small savings invested in utility stocks going the way of so many other investments since 1929, will not breathe easily until they know whether the House provisions remain in and the "death sentence" stays out. Mr. Kennedy, head of SEC, remarks calmly that either version leaves much to be desired in the way of sane, enforceable legislation. Perhaps the Supreme Court will also have an opinion, sooner or later.

The Banking Bill apparently can be counted as a victory for Senator Glass. At least he managed to keep out most of the elements he disliked. Differences with the administration are reported to be minor ones. No objection has been raised to the dropping of the Secretary of the Treasury and the Controller from the Federal Reserve Board.

With the Wagner Labor Disputes Act on the statute books there is now little chance for the 30-hour bill or any compromise that might be based on that measure. For a time there was a chance that the measure might be put through on a 36- or 40-hour basis.

Getting Serious About Taxes

Thorough-going tax revision may grow out of the inheritance and income tax recommendations of the Administration. There is growing sentiment in Congress for substantial reduction of the deficit through increased taxes as well as by scrutiny of outgo. All money raised by the taxes proposed by the President is to be definitely earmarked for the reduction of future borrowing and the paying off of the public debt.

Every industrialist and business man who has been called to Washington and has gone down there at considerable personal sacrifice because he thought he saw a chance to be of service to the country knows by this time that he has been kidded by a master of the art. Five more of them resigned recently in exasperation and it is turning out to be a job to replace them.

The fact is that a very considerable segment of business sentiment, however, is to the effect that representative business men should accept advisory or administrative positions in the government whenever offered. On the theory that at least somebody should be in a position to combat the Brain Trust proposals BEFORE they are finally jelled, and the stubborn Roosevelt jaw is set on them as "MY policies."

Not because those holding this view believe that the President would yield to conservative advice very often, but that if only one in twenty of the radical and theoretical proposals could be shunted on a sidetrack it would be a definite service to the country.

What Is Going On

Also, Business likes to know what is going on, and men even in advisory positions at the Capitol, no matter how little attention may be paid to their recommendations, or how seldom their opinions are asked, will find out a considerable part of what is going on.

President Roosevelt's intervention has given some semblance of order to the work relief program. There is no indication yet of an intention to undertake any considerable volume of work in the near future but local authorities now know, at least, where to go with their project proposals as a result of the statement, issued from the White House over the signature of Administrators Hopkins and Ickes, under which the Works Progress Administration will have charge of all projects costing, complete, not more than $25,000. All projects over that figure will be handled by PWA, except parks, playgrounds, farm-to-market roads and similar dirt-moving jobs involving little actual construction. These form an independent category that, regardless of cost, will be financed and supervised by WPA. Hopkins will also have charge of white collar activities.

A 45 per cent grant is available on all PWA projects and the remainder may be borrowed from PWA at 4 per cent if the sponsor is unable to obtain the loan elsewhere on more favorable terms. Sponsors of WPA projects will be called upon to contribute to the full extent of their ability and priority will be given to project applications on this basis. Cities which undertake one or more PWA projects, however, will not be called upon to contribute as much for WPA work as they might have to otherwise.

NRA in the immediate future apparently is not going to amount to much. Washington has told applicants for voluntary codes to see the Federal Trade Commission about reviving old FTC agreements or framing new ones. So far about 60 inquiries about such agreements have reached FTC. Nineteen directed to NRA have been passed along. FTC has been instructed to pay particular attention to anti-trust law phases. John Dickinson has resigned as Assistant Secretary of Commerce to head up anti-trust law division of Department of Justice. About 8 per cent of the NRA personnel has been "liquidated," the others to be dropped will be off the payroll within the next 60 to 90 days.

As an exponent of efficiency in industry John Dickinson, new head of the anti-trust division of the Department of Justice, is not likely to rush into court until he is sure the spirit of the statute is being violated. He is expected to be sympathetic with efforts to increase stability through the use of such expedients as common sales agencies to which many industries now are turning.

Rules Out "Blank Check"

Comptroller-General McCarl has ruled out the so-called "blank check" clause in government contracts which was the administration's effort to continue NRA code requirements in force in so far as government purchasing was involved. Treasury's Procurement Division wanted a blanket promise from bidders to abide by subsequent wage, hour and child-labor limitations proposed in the pending Walsh bill, presumably with no changes in contract prices. McCarl visualized either (1) unnecessarily high prices to cover the "blank check" or (2) subsequent demands for price readjustment. "Contracts obligating appropriations," he says, "must be definite and certain." The ruling: A clause promising modification of the contract to conform to later legislation may properly be regarded only as a request to bidders, not as a command. A low bid omitting this stipulation is still a valid bid.

No general analysis has been made

as yet of the flock of NRA code provision breakdown complaints that are being routed to the special board set up by the President. From what has leaked out so far it seems certain that code hours and wages are being maintained in the larger plants in industry with the possible exception of the boot and shoe industry where there is a bad competitive situation. The violations complained of are occurring in the smaller plants, most of them insignificant. In the distribution field, however, larger units seem to be affected. All of the complaints, however, until they have been verified, should be viewed with suspicion.

Foundry Equipment Group Maintains NRA Conditions

At a recent meeting, the board of directors of the Foundry Equipment Manufacturers Association recommended that all members maintain the working hours, wage rates, including overtime rate, prohibition of child labor and other labor conditions of the NRA code of the industry.

June Machine Tool Orders Reach New High Level

Marked expansion in machine tool demand is reflected by the new high level of the index prepared by the National Machine Tool Builders' Association, which reached 91.1 in June, exceeding the 15-year average for the first time since early in 1930. While there was some increase in foreign business, this accounted for only 17 per cent of the total, indicating a wholesome advance in the domestic market.

Not all of the improvement can be translated into units of machines because of advancing costs which have brought a number of belated adjustments in prices. These have risen from three to fifteen per cent above former lists. But making all allowances for such price changes, there is unmistakable evidence of improvement.

As shown in Table II, both large and small companies participated in the June advance. The large companies showed a greater percentage of improvement above May, but both groups attained new high points for their respective indexes. The June orders represent a 24 per cent advance in business over the preceding month, and are over two and a half times the corresponding figure for 1934.

Amtorg Buys Again From American Plants

Another $1,500,000 worth of machine tools and allied equipment has been purchased from American firms by the Amtorg Trading Corporation, according to the American-Russian Chamber of Commerce. These orders were principally for automobile plants in the Soviet Union. Other recent purchases totaled $3,000,000 (*AM*—Vol. 79, page 496c). Among the firms that participated in the second group of orders were: Pratt & Whitney Company, Cone Automatic Machine Company, Blanchard Machine Company, Lees-Bradner Company, Reed-Prentice Company, Black & Decker Mfg. Company, Greenlee Brothers Company, Abrasive Machine Tool Company, Snyder Tool & Eng. Company, Giddings & Lewis Machine Tool Company.

Table I—Index of Orders Based on Volume of Shipments for 1926

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1934—December	51.5	14.6	66.1	54.1	21
1935—January	52.0	13.5	65.5	61.3	20
February	41.2	10.9	53.0	61.5	20
March	48.5	13.8	62.3	60.3	21
April	54.5	11.2	65.6	60.3	17
May	57.3	16.0	73.3	67.1	21
June	75.5	15.6	91.1	76.7	17

Table II—Index of Orders—By Size of Companies

Group A—Companies reporting year's sales in 1926 of $200,000 or more:

Month	Index of Orders: Domestic	Foreign	Total	No. of Reports	% Foreign to Total Orders
1934—December	51.3	15.1	66.4	91	23
1935—January	51.6	14.3	65.9	91	22
February	42.1	11.4	53.5	98	21
March	48.0	14.4	62.4	94	23
April	54.8	11.8	66.6	94	18
May	57.3	16.7	74.0	83	23
June	76.0	16.0	92.0	88	17
Group B—Companies reporting year's sales in 1926 of less than $200,000:					
1934—December	55.6	7.3	62.9	76	12
1935—January	57.1	1.9	59.0	78	3
February	42.1	4.5	46.6	81	10
March	55.7	5.5	61.2	78	9
April	48.0	3.8	51.8	75	7
May	57.3	3.2	60.5	55	5
June	68.1	10.9	79.0	69	14

Table III—Distribution of Orders

(Shown by indexes of individual companies)

New Orders in % of 1926 Shipments	Number of Reports in Each Index Group: Dec.	Jan.	Feb.	Mar.	April	May	June
200 or more	9	10	6	6	7	6	14
100–199	25	21	19	25	21	21	31
90–99	5	5	5	8	3	8	8
80–89	4	10	3	5	9	3	8
70–79	6	8	10	9	13	11	10
60–69	7	10	8	7	13	6	10
50–59	18	10	18	15	13	8	5
40–49	16	13	18	21	16	9	7
30–39	14	12	21	21	14	11	15
20–29	17	21	23	13	17	15	15
10–19	24	22	18	23	18	11	14
Less than 10	22	27	30	19	25	29	20
Total Reports	167	169	179	172	169	138	157

Engineers' Council Starts Plan to Accredit Schools

A program for accrediting engineering schools in New England and the Middle Atlantic States was announced last week by the Engineers' Council for Professional Development, which is sponsored by leading national engineering societies, engineering educators and engineering examiners. After a trial period, the program will be offered to other parts of the country.

Accrediting of engineering schools is necessary because the majority of the states have enacted laws for the licensing of engineers, and licensing procedure requires a list of accredited colleges whose graduates may submit evidence of their graduation in partial fulfillment of the requirements of licensure. The Engineers' Council for Professional Development is undertaking this work because it is the only body which represents all of the interested groups.

Through the Council, regional subcommittees have been organized to visit each institution requesting recognition for its curricula. Visits by these committees will begin early in the fall, and it is expected that accrediting in these regions will be well under way before the first of the year.

Push Work on New Auto Models; Plants Expanding, Tool Orders Placed

DETROIT—With encouraging sales already reported for the latter part of June, activity in new car output continues apace. Orders for production tools to complete factory set-ups, ordinarily coming in September, are just now filtering into production tool shops fully two months ahead of the customary time. Up to two weeks ago, productive tool orders were anywhere from 25 to 40 per cent under the average for February, March and April.

Nash, through the Lafayette introduced the first of the month, leads the 1936 procession. With the seamless steel top body in two stampings, Nash continues the pioneering of General Motors. Tooling programs indicate that body changes will not be as great as in times past. Die shops are busier than a month ago, with the medium-sized shops working at about 60 per cent capacity, the larger about 80 per cent and the small at less than 50 per cent it is estimated.

While price is a very important factor in the tool and die business at present, wage rates established under the code are generally reported as being maintained with hours on the same basis as corporation shops. Prices of productive materials are holding well, the desire is evidently to prevent repercussions on labor which radical adjustments in price structures would inevitably cause.

Tool Orders Strong

Inquiries and closings in the machinery field continue the favorable condition reported in the last number; inquiries strong, closings good, and although no big programs are in sight, a decided spirit of optimism prevails. Activity in Flint and Saginaw is pronounced and the expansion at Plymouth, announced July 5, to increase the capacity to 2,400 units per day is a bullish influence as is also the prospective opening of the Pontiac foundry, expansion of the Briggs Mack Ave. plant, and others. The increase in automotive output this year has resulted in a marked increase in capital expenditures for conveyors and material handling equipment to increase the speed of production. Instead of the usual curtailment in this line at this time of year, an expansion is resulting, not only for reasons just mentioned, but because revisions and rearrangements for new model production are accounting for a mounting portion of the business. Business double and triple that of last year is reported as is the case also with heavy equipment such as compressors. The sustained nature of the automobile business this year and its increase over that of last year with its accompanying improvement in profit position has undoubtedly led to a willingness to venture into new expenditures here and improvements there which up to a year ago would not be considered.

Profit prospects for special machine tool plants for 1935 are ahead of last year with current results considerably better. Interest in diesel development is increasing and the expectation is in some quarters that trucks above two tons capacity will be so powered within five years.

A policy is in the making which may have a considerable effect on some branches of the industry in months to come. With interest rates as low as they are at present, it is becoming profitable to tie up funds in inventory rather than permit them to remain idle or practically so at a low interest rate. It is understood that some of the larger units will plan, in conjunction with new model production, for larger banks of parts within the system than has hitherto been the case. The value of a policy of this sort is immediately apparent to parts suppliers as well as to continuity of employment in the assembly plant itself. A more even spread of production throughout the system becomes possible when scheduling is done to banks rather than to specific customers orders on those parts which do not involve consumer preferences. The argument frequently advanced that unpredictable moves by competitors prevent this action has been used as an excuse in the past.

Industrial Review

• Statements from almost every section of the country indicate that machine tool and machinery sales are continuing at a level much above what had been expected for this summer. Several machine tool builders are booked solidly well into the autumn and a few are quoting 1936 deliveries. Part of this situation is due, of course, to the shortage of certain types of skilled men, and manufacturers are being hard put to satisfy customers and maintain code hours, while at the same time they are under pressure from their men to lengthen the work week. The placing of nearly $5,000,000 worth of Russian business recently has helped the machine tool picture somewhat.

• Boston reports a fading off of inquiry but a fairly well sustained flow of orders. New York has suffered a sharp drop in activity during the current month. In Philadelphia the tone is better but buying has not been quite up to expectations. Pittsburgh distributors, on the other hand, are finding July an active month. Orders are well up to the average for the last three months, and that average was pretty good.

• Labor troubles in Cleveland are less numerous than for some weeks past. Business is at a higher level than it was in January but is not quite up to the May peak. Detroit reports some dropping off in orders but expects a sharp recovery not later than August 20. Orders for replacements are being placed now and some important "programs" for the fall are being discussed. In Indianapolis business is continuing at a very good level for this time of year, and prospects for the rest of the year are decidedly favorable.

• Cincinnati also reports a remarkably high level of orders for this period. A few of the local machine tool plants are operating at capacity and deliveries are being quoted several months ahead. Several manufacturers report June sales as the best in six years with July prospects equally good. Inquiry in St. Louis is light but a very fair volume of orders is being placed. Small tools are more active. Distributors have high hopes that no real summer slump will develop.

• Machinery sales continue to be unusually good in the district around Chicago. Plenty of good prospects are in view and the trade is optimistic. On the West Coast this summer is the best in a number of years. Even one of the railroads has placed a small order.

While the labor situation is undisturbed at present, considerable apprehension exists in some quarters as to the effect the Wagner bill is likely to have, although considered opinion seems to be that the act is unconstitutional and will be tested at the first opportunity. Despite the failure of the A. F. of L. to make any marked progress in organizing automobile workers up to the present time, Father Coughlin has anounced a Labor Day assembly for this purpose. The aim is $2,150 for each worker per year.

With suppliers variously reporting appreciable drops in schedules, it is evident that July output will not be equal to June. From 385,506 units in May, output in June is expected to run between 300,000 and 340,000. Sales of new passenger cars in the United States in May totaled 293,201, according to R. L. Polk & Company figures, which represent a reduction under April of something more than 8 per cent. June sales are still in the tabulation stage, but the last of the month reports of individual companies indicate an unexpected rise, aided doubtless by the holiday prospect as the industry generally was closed from Wednesday the third till the eighth. Hudson gained 32.3 per cent the week ending June 29 over the previous week. Dodge dealers reported the second highest week's business in history for the same period, while Chevrolet production for July is reported at only slightly under the June level of 125,000. Packard is still struggling with a bank of 3,000 unfilled orders for the "120" with a capacity schedule of 6,400 cars for July. Chrysler dealers reported an increase of 2.9 per cent in sales the week ending June 22.

Despite this last minute rush and in view of an estimated 30-day stock of new cars at the current rate of sales, the expectation is that August will show a very low rate of output.

Conference Board Reports Rise in Bonus Systems

Based on a report covering 631 companies, employing more than 700,000 wage earners, the National Industrial Conference Board, in a survey of financial incentives in modern industry, found that premium and bonus systems of wage payment in effect in 1935 cover approximately three times as many wage earners as in 1924. In the same interval the proportion of wage earners on piece rates has dropped two-fifths while the proportion on time rates is virtually unchanged.

Premium plans are relatively more popular in the medium sized plants than in either the very large or very small establishments. NRA, according to this report, did not have a uniform effect on wage incentive plans. Three times as many companies reported that NRA had increased the use of incentives as those which found it had the opposite effect.

N.M.T.B.A. Finds New Industries Absorb Labor

Almost one seventh of all the labor employed in manufacturing activities in 1929 was caused by eighteen new industries, which have been created by advances in science, invention and technology and which did not exist in 1879, according to a report to the National Machine Tool Builders' Association by the National Industrial Conference Board. The Conference Board is conducting a survey of mechanization in industry, technological progress and related conditions for the N.M.T.B.A.

The accompanying table gives these eighteen new industries, showing in each case the average number of wage earners employed in 1929. The total of 1,123,314 workers thus accounted for does not, however, measure the total contribution of science, invention, and technology to increased employment. It does not indicate the number of new jobs created in such important fields of activity as public utilities, and various transportation and distribution industries required for the marketing of goods and services produced by the newly established manufacturing industries. Nor does it give credit to the increases in the volume of employment effected in the established industries supplying raw materials or basic manufactured commodities utilized in the creation of these new products. Mining activities alone required four times the number of workers in 1930 as in 1880.

Table I—Partial List of New Manufacturing Industries

Industry	Average No. Wage-Earners—1929
Electrical machinery, apparatus and supplies	328,722
Motor vehicles (not including motorcycles)	226,116
Motor vehicles, bodies and parts	221,332
Rubber tires and inner tubes	83,263
Manufacture of gasoline	39,411
Rayon and allied products	39,106
Manufactured ice	32,184
Aluminum manufactures	21,210
Typewriters and parts	16,945
Refrigerators, mechanical	16,883
Cash registers and adding and computing machines	16,840
Oil, cake and meal, cottonseed	15,825
Aircraft and parts	14,710
Phonographs	14,416
Photographic apparatus and materials	12,967
Motion picture apparatus (except for projection in theater)	10,784
Asbestos products[1]	8,092
Fountain pens[2]	4,508
Total, 18 new industries	1,123,314
Total all manufacturing industries	8,838,743

[1]Excluding steam packing and pipe and boiler covering.
[2]Estimated.

A. S. T. E. Charters Boat to Machine Tool Show

One of the largest inland steamers, the *Greater Detroit*, has been chartered by the American Society of Tool Engineers to take members to the Machine Tool Show, Sept. 11-21. The society has been invited to take part in the Machine Tool Congress along with the Production Activity Division of the Society of Automotive Engineers and the Machine Shop Practice Division of the American Society of Mechanical Engineers. These three groups are arranging technical sessions. September 13 is to be "A.S.T.E Day" at the Show. The boat will leave Detroit on Thursday evening, Sept. 12.

Soviets Build More Intricate Machines

Three types of revolving automatic lathes and four types of semi-automatic lathes will be built in Russia for the first time in 1935. Production of seventeen types and sizes of special machine tools will also be begun for the motor and transport engineering industries. These data indicate the emphasis that the Soviet Union is placing on production equipment, because heretofore the simpler machines have been built almost exclusively. Power and intricacy of Russian machine tools should increase during the remaining years of the Second Five-Year Plan, according to the *Bulletin of Economic Information* published by the U.S.S.R. Chamber of Commerce at Moscow.

During the last seven years the fixed capital of the Soviet machine tool industry has increased almost seven times, and in the last five years the in-

crease has been two and one-half times. In October 1928 the plants coming under the Head Office for Tool and Machine Tool Manufacture had a capital of 15,200,000 rubles, but this had increased by January 1935 to 115,000,000 rubles. Output has grown rapidly. The value in 1931 was 33,500,000 rubles whereas in 1935 the planned output will be worth 236,000,000 rubles. In 1934 the output was valued at 127,000,000 rubles, and comprised 18,000 machines. During 1934 there were 41 plants building machine tools but this number is to be increased to 48 in the current year.

During the last year of the Second Five-Year Plan, 1937, it is proposed to build 40,000 machines. The following figures indicate the relative importance of the main groups of machine tools in the total production for the last years of the First and Second Five-Year Plans:

Machine Tool Group	1932	1937
Turning	42.7	36.4
Drilling	30.4	15.8
Milling	3.8	12.9
Gear-Cutting	0.6	2.4
Polishing	2.0	14.9

Altogether 250 different sizes and types are to be produced.

PERSONALS

P. S. McCutcheon is now general manager of the Sleeper & Hartley, Inc., Worcester, Mass., manufacturers of spring machinery, flexible casing machinery, cable armoring machinery, flexible tube machinery and wire mill machinery. W. H. Blount is also connected with the active management of the properties. C. S. Arms continues as consulting engineer on wire mill equipment.

James J. Zimmerman has been appointed works manager by the Osborn Machine Co., Dubois, Pa. Mr. Zimmerman formerly served as production manager for the Elliott Co., Jeannette, Pa., assistant general superintendent of the Scott Foundry, Reading Iron Co., Reading, Pa., and in various capacities with the Cambria Steel Co., of Johnstown, Pa.

P. J. Potter, formerly second vice-president of the Pangborn Corp., Hagerstown, Md., manufacturers of dust collecting equipment, was elected a director and vice-president recently. Mr. Potter will be directly responsible for engineering, sales and production. He has been associated with the Pangborn organization for 20 years. In 1922 he became works manager of the foundry and manufacturing plant. In 1931 he was elected a second vice-president.

Lynn Johnson has been elected president of the Westlake Mfg. Corp., Canastota, N. Y., manufacturer of fuel-saving devices and automotive equipment. Other officers are: Charles P. Cady, vice-president and general manager, Lyndon Cornell, secretary and sales manager, and Clarence Conley, treasurer.

OBITUARIES

Andre Gustave Citroen, often called the "Henry Ford of France," died recently from a stomach disorder aggravated by worry over the receivership for his company. He began producing a 10-hp. car in 1919 along American mass production lines. Citröen's production rose to 400 cars per day, and it has been said that at one time 40 per cent of the cars in France were of that make.

Mr. Citröen purchased much equipment from the United States and frequently visited here to keep abreast of the latest American practice. He had license agreements and other arrangements with several American manufacturers.

John Bath, 72, president and treasurer of John Bath and Co., Worcester, Mass., manufacturer of ground taps and small tools, died July 9. He established the company 23 years ago. Mr. Bath was for many years a member of the A.S.M.E.

MEETINGS

American Society for Metals. Seventeenth annual meeting, Sept. 30-Oct. 4. Palmer House, Chicago, Ill., W. H. Eisenman, secretary, 7016 Euclid Ave., Chicago.

American Welding Society. Fall meeting, Sept. 30-Oct. 4. Chicago, Ill. M. M. Kelly, secretary, 33 West 39th St., New York, N. Y.

Economics Conference. Fifth annual for engineers, Aug. 10-17. Stevens Engineering Camp, Johnsonburg, N. J. For reservations, Stevens Institute of Technology, Hoboken, N. J.

International Acetylene Association. Thirty-sixth annual convention, Nov. 12-15. Cleveland Hotel, Cleveland, Ohio. H. F. Reinhard, secretary, 30 East 42d St., New York, N. Y.

National Industrial Advertising Association. Convention, Sept. 18-20. William Penn Hotel, Pittsburgh. W. J. Ramsey, Industrial Advertising Council, Box 1198, Pittsburgh, Pa.

Exports of Machinery During May, 1935

	May 1935	April 1935	May 1934
Electrical machinery	$6,331,748	$6,779,526	$5,263,026
Power generating machinery (except automotive and electric)	678,790	894,015	461,843
Construction and conveying machinery	576,609	557,771	486,232
Mining, well and pumping machinery	2,271,456	2,261,462	1,431,632
Power-driven, metal-working machinery	2,307,783	2,179,256	1,596,546
Other metal-working machinery	208,570	220,428	168,193
Textile machinery	559,726	741,228	591,322

Exports of Metal-Working Machinery During May, 1935

	May 1935	April 1935	May 1934
Engine lathes	$236,955	$262,287	$43,777
Turret lathes	62,431	70,597	54,949
Other lathes	92,163	77,163	29,109
Vertical boring mills and chucking machines	67,356	75,358	34,906
Thread cutting and automatic screw machines	85,419	111,847	109,743
Knee and column type milling machines	41,376	104,004	62,411
Other milling machines	108,336	108,195	187,109
Gear cutting machines	153,457	92,229	115,210
Vertical drilling machines	70,392	46,278	18,177
Radial drilling machines	7,155	27,825	21,076
Other drilling machines	70,553	113,517	82,478
Planers and shapers	48,127	21,041	32,809
Surface grinding machines	60,763	46,823	28,788
External cylindrical grinding machines	60,191	121,232	58,717
Internal grinding machines	102,884	76,573	71,358
Tool grinding, cutter grinding, and universal grinding machines	140,297	68,126	54,473
Other metal-grinding machines	83,137	59,049	75,595
Sheet and plate metal-working machines	98,766	203,273	87,345
Forging machinery	174,212	101,546	75,709
Rolling mill machinery	203,022	113,929	108,379
Foundry and molding equipment	69,279	41,425	46,901
Other power-driven metal-working machinery and parts	271,512	236,939	197,347
Other Metal-Working Machinery			
Pneumatic portable tools	46,667	63,298	56,610
Other portable and hand or foot operated metal-working machines and parts	47,002	69,293	46,425
Chucks for machine tools	10,916	11,680	11,003
Machine operated pipe and thread cutters, stocks, dies, taps and other machine-operated cutting tools	49,304	37,402	36,842
Other metal-working machine tools	54,681	38,755	17,313

NATIONAL METAL EXPOSITION. Seventeenth annual congress, Sept. 30-Oct. 4. International Amphitheater, Chicago, Ill., W. H. EISENMAN, secretary, 7016 Euclid Ave., Cleveland, Ohio.

MACHINE TOOL CONGRESS. Cleveland, Sept. 11-21. Under auspices of National Machine Tool Builders' Association. Participating societies: Machine Shop Practice Division, American Society of Mechanical Engineers; Production Activity Division, Society of Automotive Engineers; American Society of Tool Engineers. HERMAN H. LIND, general manager, 1220 Guarantee Title Bldg., Cleveland.

MACHINE TOOL SHOW. Sept. 11-21, Public Auditorium, Cleveland, Ohio. HERMAN H. LIND, general manager, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SILVER BAY CONFERENCE. Eighteenth annual conference on industrial relations, August 28-31. Silver Bay, Lake George, New York, N. Y. E. C. WORMAN, executive secretary, 347 Madison Ave., New York, N. Y.

BUSINESS ITEMS

The Hill Clutch Machine & Foundry Co., 6400 Breakwater Ave., Cleveland, Ohio, has purchased all the assets of The Canton Foundry & Machine Co., Canton, Ohio, but the latter will continue to operate under its own name as a division of the Hill Co. The main offices of Canton Foundry will remain at Canton, Ohio, for the present, and the factory at Cleveland. Officers of the Canton Foundry & Machine Co. Division will be J. R. BUCHER, president, A. C. MCDANIEL, vice-president, and MILO FIRESTONE, secretary and treasurer.

The Apex Machine & Tool Co., Dayton, Ohio, has purchased the Schellanbach-Hunt Tool Co., Cincinnati, manufacturer of adjustable and expansion reamers and will promote their distribution. The Apex Co. manufactures drill chucks and tool holders.

The Buell Engineering Co., Inc., 70 Pine St., New York, N. Y., has been formed to manufacture drying systems of the rotary, turbo and fine-film types, as well as a system for dust extraction. Manufacturing operations will be undertaken by the Struthers-Wells-Titusville Corp., Warren, Pa.

The Marr-Galbreath Machinery Co., 55 Water St., Pittsburgh, Pa., has purchased the entire plant of the Lincoln Scale Corp., Latrobe, Pa. All machines and small tools are available for immediate disposal.

The Millholland Sales & Machine Co., Indianapolis, Ind., has appointed agents for the new line of turret lathes, cam-operated drilling, tapping and milling units, leadscrew tapping units, and hydraulic drilling units as follows: Arch Machinery Co., 1029 Park Bldg., Pittsburgh; Kemp Machinery Co., 211 President St., Baltimore; Triplex Machine Tool Co., 125 Barclay St., New York; F. E. Saterlee Co., 118 Washington Ave. North, Minneapolis; for turret lathes only, General Machinery Co., 140 Federal St., Boston.

The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, has opened a direct factory branch at the Curtiss Bldg., 2842 West Grand Blvd., Detroit, in charge of REIDER THORESON.

The Reed-Prentice Corp., Worcester, Mass., has appointed the J. S. Miller Machinery Co. as exclusive agents in the Pittsburgh territory for the sale of machine tools including engine, toolroom and production lathes, vertical milling and die-sinking machines.

The Osborn Machine Co., Dubois, Pa., manufacturer of foundry, machine shop and boiler-shop equipment, has opened a sales office at Pittsburgh, 820 Empire Bldg., with C. K. WEHN, general sales manager in charge.

The Farrell-Birmingham Co., Inc., Buffalo, N. Y., has appointed the Sterling-French Machinery Co., New Center Bldg., Detroit, as sales representative for the Sykes gear generators in the Detroit territory.

GEORGE G. PRAGST, for 13 years a sales engineer for the Franklin Machine Co., Providence, R. I., has opened an office as a manufacturer's agent for machinery, small tools and hardware. He has space with the Lincoln Machine Co., 260 Esten Ave., Box 196, Pawtucket, R. I.

A school for welding operators has been opened by the Harnischfeger Corp., at its Eastern sales office, 1714 Willow Avenue, Hoboken, N. J., under the supervision of WILLIAM BOZMAN.

PATENTS

July 2, 1935

Metal-Working Machinery

Machine for Knurling or Forming Teeth in Axles. Charles A. Adams, Ellwood City, and Gomer F. Owens, Wayne Township, Pa., assigned to Mathews Conveyor Co. Patent 2,006,332.

Fabrication of Flexible Shafting. Robert C. Angell, Prince Bay, N. Y., and Frank L. O. Wadsworth, Pittsburgh, Pa., assigned to The S. S. White Dental Manufacturing Co. Patent 2,006,333.

Electric Welding Machine for All-Metal Spools. John G. Jones and Haywood G. Dewey, Rochester, N. Y., assigned to Eastman Kodak Co. Patent 2,006,459.

Machine Tool. Robert S. Brown, New Britain, Conn., assigned to The New Britain-Gridley Machine Co. Patent 2,006,496.

Welding Machine. Charles Eisler, Newark, N. J., assigned to Eisler Engineering Co. Patent 2,006,544.

Grinding Machine. Charles Herfurth, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 2,006,554.

Grinding Machinery. Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 2,006,570.

Grinding Machine. Frederick J. Theler, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 2,006,724.

Spindle Feed Mechanism. Lora E. Poole, Anderson, Ind., assigned to General Motors Corp. Patent 2,006,746.

Machine for Producing Gears. Robert S. Condon, Rochester, N. Y., assigned to Gleason Works. Patent 2,006,790.

Clutch Throwing Mechanism. Kurt H. Conley, Bridgeport, Conn., assigned to the Bullard Co. Patent 2,006,913.

Tools and Attachments

Mandrel for Electric Welding Machines. Howard J. Burnish, Sewickley, Pa., assigned to Spang, Chalfant & Co., Inc. Patent 2,006,581.

Motor Operated Chuck for Lathes and Other Machine Tools. Wilhelm Berg, Bielefeld, Germany. Patent 2,006,621.

Truing Device. Ervin L. Ackley, Worcester, Mass., assigned to John Bath & Co. Patent 2,006,783.

Ball Bearing Center. Edward F. G. Gibbs, Detroit, Mich. Patent 2,006,801.

Device for Setting and Protecting Diamond-Edged Tools and the Like. Wilhelm Winter, Hamburg, Germany. Patent 2,006,864.

Tumbler Trimming Tool. Raymond W. Griffith, Milwaukee, Wis., assigned to Briggs & Stratton Corp. Patent 2,006,916.

Processes

Method of Welding Spools. John G. Jones and Haywood G. Dewey, Rochester, N. Y., assigned to Eastman Kodak Co. Patent 2,006,458.

Method and Apparatus for Cutting Gears. Bernard Edward Schlesinger, Irondequoit, N. Y., assigned to Gleason Works. Patent 2,006,750.

Method of Producing Seamless Spherical Pressure Vessels. William G. Hulbert and Joseph A. Thierry, Easton, Pa., assigned to Taylor-Wharton Iron & Steel Co. Patent 2,006,894.

July 9, 1935

Metal-Working Machinery

Device for Moving a Machine Member or Other Part, by Power Means, an Exact Distance or to an Exact Position. John E. Doran, John M. Walter, and Forrest E. Cardullo, Cincinnati, Ohio, assigned to The G. A. Gray Co. Patent 2,007,180.

Electric Arc Cutting Machine. Karl Strobel, Whittier, Calif., assigned to Karl Strobel Corp. Patent 2,007,222.

Duplicating Machine. Edmund Leo Wall, Detroit, Mich., assigned to R. W. Glasner. Patent 2,007,231.

Automatic Carriage Control for Duplicating Machines. Edmund Leo Wall, Detroit, Mich., assigned to R. W. Glasner. Patent 2,007,232.

Bending Machine for Making Metal Tubes. Albert Rafter, Glen Ridge, N. J., assigned to Rafter Machine Co. Patent 2,007,284.

Power Press. Ross B. Treer, Lakewood, Ohio, assigned to The Cleveland Punch & Shear Works Co. Patent 2,007,290.

Knee and Column Milling and Like Machine. Richard Stuhlmacher, Siegmar, near Chemnitz, Germany, assigned to Wanderer-Werke Vorm. Winklhofer & Jaenicke A.G. Patent 2,007,314.

Roll Grinding Machine. Amos P. Steiner and Harold E. Balsiger, Waynesboro, Pa., assigned to Landis Tool Co. Patent 2,007,351.

Lathe and Like Machine Tool. Reginald John Dixon, Coventry, England, assigned to A. C. Wickman, Ltd. Patent 2,007,564.

Automatic Arc Welding. Verni J. Chapman, Schenectady, N. Y., assigned to General Electric Co. Patent 2,007,751.

Milling Machine. Henry O. Fletcher, Manchester, N. H. Patent 2,007,827.

Tools and Attachments

Electric Welding Head. Elvin S. Goodspeed, Detroit, Mich., assigned to General Motors Corp. Patent 2,007,602.

Thickness Gauge. Spencer B. Terry, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 2,007,840.

Tracer. John C. Shaw and Robert D. Shaw, Hartford, Conn., assigned to Pratt & Whitney Co. Patent 2,007,899.

American Machinist
REFERENCE BOOK SHEET

Electrodeposited Coatings of Nickel and Chromium on Steel

The specifications in this tentative standard are published through the courtesy of the American Society for Testing Materials. They were prepared by that Society in cooperation with the American Electro-Platers' Society and the National Bureau of Standards.

Scope

1. These specifications cover requirements for electroplated coatings on steel articles including a final coating of nickel or chromium where both appearance and protection against corrosion of the base metal are important. Two types of coating (Notes 1 and 2) are covered: namely,

Type KS.—For general service.
Type QS.—For mild service.

NOTE 1: *Explanation of symbols.*—The initial letters *K* and *Q* were adopted as arbitrary designations of grades of plating. The second letter (*S*) refers to steel as the base metal; to provide for other base metals such as brass (*B*) and zinc (*Z*).

NOTE 2: *Classification.*—The conditions of exposure and use of plated steel are so varied that it is not possible to predict the average life of articles plated in accordance with Type *KS* or Type *QS*, or to predetermine just which type of plating should be specified for a given article. Such a selection must be based upon the experience of the manufacturers and users.

It is recognized that uses exist for which thicker coatings than those of Type *KS* will be required.

For articles that are intended for a short period of use, no standard specification for plating is recommended. It is suggested, however, that subject to the prevailing manufacturing conditions, certain minimum requirements be mutually agreed upon by the manufacturer and purchaser in order to insure that the plated coatings render a useful service.

Manufacture

2. The steel to be plated shall be substantially free from flaws or defects that will be detrimental to the final finish. It shall be subjected to such polishing, cleaning, pickling and plating procedures as are necessary to yield deposits with the desired appearance and quality. The use of copper as an initial or intermediate layer is optional, and subject to the requirements specified in Sections 3 and 4. The coatings shall have a bright or dull finish as specified, shall be adherent and free from blisters, and substantially free from pits or other surface defects.

Thickness of Deposits, Type KS

3. (*a*) *Nickel and Copper.*—For Type *KS* coating on significant surfaces of the finished articles, the minimum thickness of the nickel coating, or of the combined layers of copper and nickel, shall be 0.00075 in., and if copper is used, the minimum thickness of the final nickel layer shall be 0.0004 in.

(*b*) *Chromium.*—If a chromium finish is specified, the minimum thickness of the copper and nickel layers on significant surfaces shall be as specified in Paragraph (*a*), and the average[1] thickness of the chromium coating shall be not less than 0.00002 in.

Thickness of Deposits, Type QS

4. (*a*) *Nickel and Copper.*—For Type *QS* coating on significant surfaces of the finished articles, the minimum thickness of the nickel coating, or of the combined layers of copper and nickel, shall be 0.0004 in., and if copper is used, the minimum thickness of the final nickel layer shall be 0.0002 in.

(*b*) *Chromium.*—If a chromium finish is specified, the minimum thickness of the copper and nickel layers on significant surfaces shall be as specified in Paragraph (*a*), and the average[1] thickness of the chromium coating shall be not less than 0.00002 in.

Thickness Measurements

5. (*a*) The minimum thicknesses of the copper and nickel coatings shall be determined by microscopic examination of cross-sections taken perpendicular to significant surfaces.

(*b*) The average thickness of the chromium coating shall be determined by microscopic examination of cross-sections taken perpendicular to significant surfaces, by stripping methods, or by other methods as agreed upon by the manufacturer and purchaser.

Continuity Tests

6. (*a*) For Type *KS* coating the plated articles shall show no appreciable corrosion on significant surfaces at the end of 48-hr. continuous exposure to the salt spray test; and for Type *QS* coating at the end of 16-hr. continuous exposure to the salt spray test (Note 3).

NOTE 3: *Preparation of Specimen.*—The specimen shall be cleaned immediately before insertion in the salt spray, so that the surface is free from "water break." This may be accomplished by any efficient method, such as cleaning with a suitable organic solvent followed by light rubbing with a cream of pure magnesium oxide.

[1] For many articles the minimum thickness of chromium is more significant, but the average thickness has been specified pending the development of satisfactory methods for measuring the minimum thickness.

Electrodeposited Coatings of Nickel and Chromium on Steel

Salt Spray Test.—The test shall be conducted with a 20 per cent solution of sodium chloride (sp. gr. 1.15) under conditions that produce a dense fog throughout the container, without the spray being blown directly against the specimens. The latter shall be supported by glass or other insulating material. The temperature in the box shall be maintained by thermostatic control at 95 F. ± 5 F. (35 C. ± 3 C.). (This is about the lowest temperature that can be maintained throughout the year without artificial cooling). The solution formed by condensation of the spray should be drained off and not used again.

(*b*) Unless otherwise agreed upon by the manufacturer and purchaser, "appreciable corrosion" shall be defined as the presence of more than six rust spots per square foot that are visible to the unaided eye, or of any rust spots larger than ⅛ in. in diameter.

Significant Surfaces

7. In general, significant surfaces are those surfaces that are visible and subjected to wear and/or corrosion. The designation of significant surfaces shall be agreed upon by the manufacturer and purchaser, and may be indicated on the drawings.

Sampling

8. Methods of sampling and resampling and the basis of rejection shall be subject to mutual agreement by the manufacturer and purchaser. The number of samples to be selected and the frequency of selection will, in general, depend upon the number of pieces to be plated.

NOTE 4: *Summary.*—The requirements of Sections 3, 4, and 6 are summarized as follows:

Minimum Thickness:	TYPE *KS* COATING	TYPE *QS* COATING
Copper plus Nickel	0.00075 in.	0.0004 in.
Final Nickel...	0.0004 in.	0.0002 in.
Average Thickness:		
Chromium (if required)	0.00002 in.	0.00002 in.
Salt spray, continuous exposure ..	48 hr.	16 hr.

Appendix

Time Required for Plating

Any specified average or minimum thickness of plating can be produced consistently only if the current density and time of plating are controlled. Regulation of the voltage is of no value except so far as it produces the desired current density.

The current and time required to produce a certain minimum thickness of any metal will depend upon the shape of the article, the shape and position of the anodes, and the throwing power of the solution. General experience indicates that average thicknesses of at least 0.001 in. and 0.0005 in. will usually be required to produce the respective minimum thicknesses of 0.00075 in. and 0.0004 in. of nickel plus copper. For complicated shapes, longer periods will be required, which must be determined by trial. When a large number of small articles are plated simultaneously (for example, on racks or in barrels), the time of plating must be increased to insure the specified thickness on those articles that receive less than the average current density.

Copper and Nickel.—To deposit an average thickness of 0.001 in. of either copper or nickel using acid baths with 90 per cent efficiency, requires about 21 amp. hr. per sq.ft. In the cyanide copper bath only about 10 amp. hr. per sq.ft. are required if the efficiency is over 90 per cent. Practically, however, the efficiency in cyanide baths may be only 50 to 70 per cent, so for illustration the above figure of 21 amp. hr. per sq.ft. will be retained for all the copper layers.

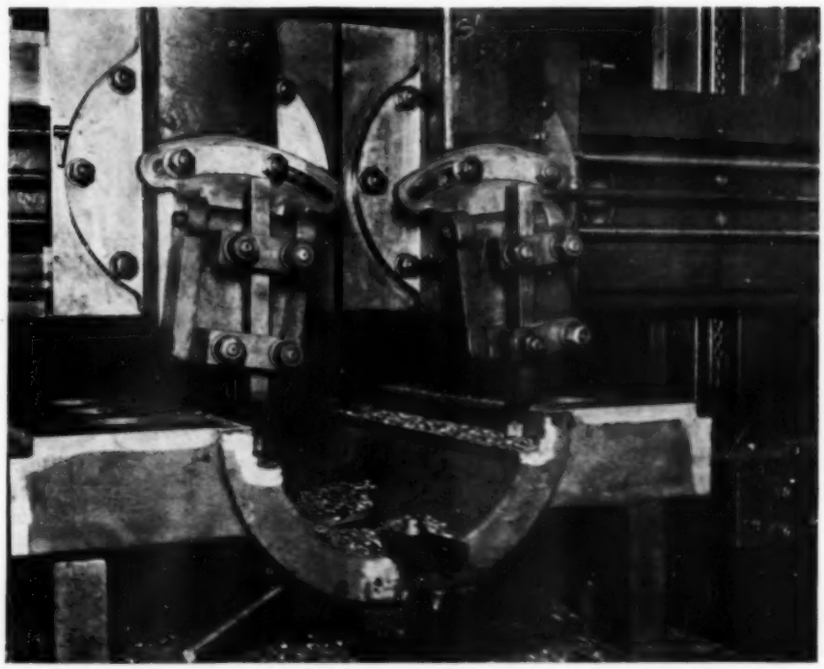
The losses in buffing may vary from 10 to 20 per cent. If the latter value is assumed for safety, this will necessitate the use of $21 + 4 = 25$ amp. hr. (1500 amp. min.) per sq.ft. to yield an average thickness of 0.001 in. of copper plus nickel on the finished articles. This is equivalent to a total of one hour's plating at 25 amp. per sq.ft., 2.5 hr. at 10 amp. per sq.ft., or to a corresponding period for any other current density. For an average thickness of 0.0005 in., half these periods will be required.

Chromium. — In chromium plating, bright deposits are usually produced with a cathode efficiency of about 12 per cent. Under these conditions it requires about 500 amp. min. per sq.ft. to produce the specified average thickness of 0.00002 in. of chromium. This is equivalent to 5 minutes plating at 100 amp. per sq.ft., or to 2.5 min. at 200 amp. per sq.ft.

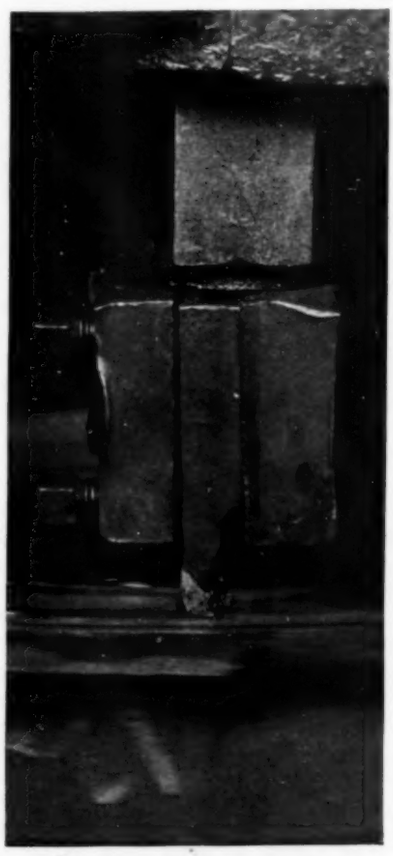
NEW Tools From Old

ELECTRIC welding has been put to such varied use in the last few years that it is natural to find it now being applied to reclaiming and making shop tools. Instead of scrapping worn lathe tools and bits, reamers, milling cutters, drills, cutting and forming dies and other tools, they can now be given a new lease on life. Such tools will perform satisfactorily because the deposit of high-speed steel will maintain its hardness (55–65 Rockwell C) at temperatures to 1,000 F., and will withstand shock on the cutting edge.

Greater savings can be made where the tool body is fabricated from low-alloy steel instead of high-speed steel and the "Toolweld" electrode is used to build up the cutting edge. Savings as high as 35 per cent are not unusual.



One of these planer tools is made from low-alloy steel tipped with "Toolweld," and it has stood up in service alongside a tool made of high-speed steel



A heavy boring tool was restored to service by applying a new tip with "Toolweld" electrode

For example: with tool steel at 50 cents per pound, low-alloy steel at 5¾ cents per pound, labor at $1.00 and overhead at $2.00, the comparison of cost for a 4-lb. tool works out as follows:

	Tool-Steel Body	Low-Alloy Steel Body
Labor	$1.00	$1.00
Overhead	2.00	2.00
Material	2.00	0.23
Total	$5.00	$3.23

Saving effected by using low-alloy steel—35 per cent.

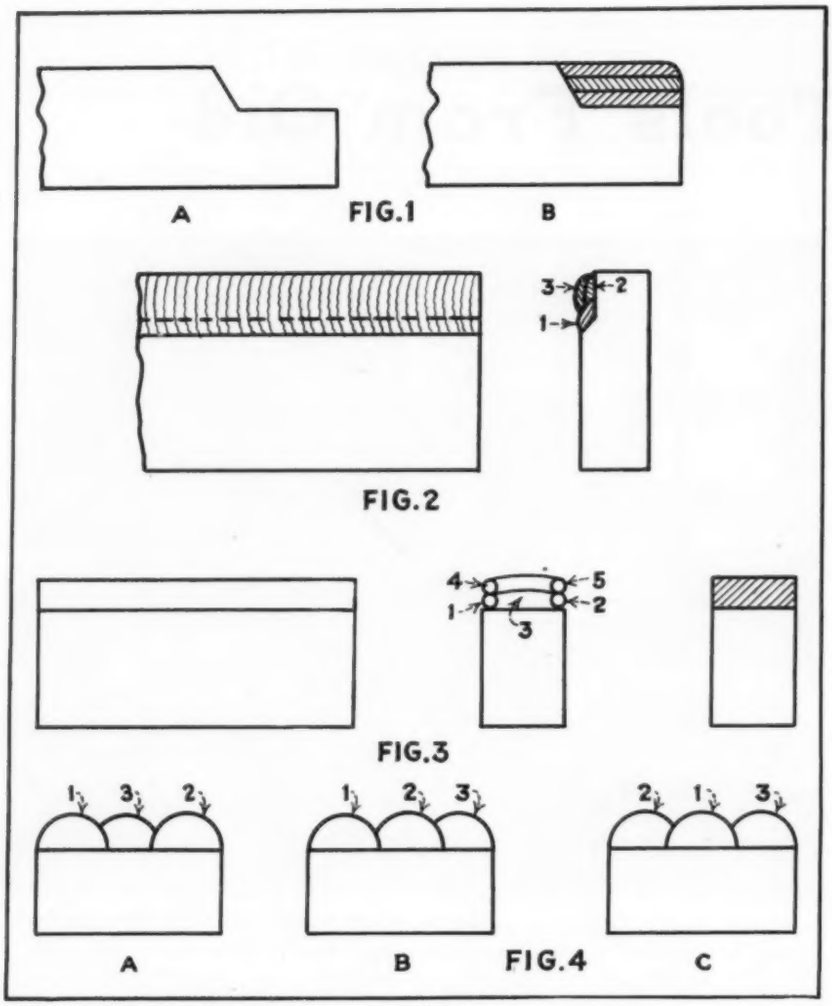
The electrode is used with reversed (plus) polarity. Although the exact values for current and arc voltage depend on the mass of the part being surfaced, and on the thickness and hardness of bead desired, the following table may be used as a guide.

Electrode Size	Current Range	Arc Voltage
5/32 in.	30- 65 amp.	21-25 volts
⅛ in.	65-100 amp.	22-26 volts
5/32 in.	90-160 amp.	23-27 volts
3/16 in.	125-200 amp.	25-29 volts

Laying the beads down with a weaving motion of the electrode reduces porosity. In welding on a vertical surface, weld from the bottom up. Slag should be removed before a second bead is deposited. Much of the slag pops off the bead during cooling, and it should not be watched at too close range.

Although Toolweld as deposited has a hardness of 55–65 Rockwell C, without heat-treatment, the degree of hardness varies, depending on the admixture of the base metal with the deposit. Hardness can be increased by permitting the deposit to cool slowly and depositing an additional bead. Where only one bead can be applied low current should be used to keep down the admixture of base metal with the deposit. Heat-treatment can be resorted to, however, because Toolweld acts similarly to high-speed steel in this respect.

In making up lathe tools a bar of mild steel of suitable size is ground or machined as shown at *A*, Fig. 1. Hot-rolled steel is preferable to cold-rolled steel because less porosity is likely to result. At *B*, Fig. 1, is shown the high-



Applying a high-speed steel deposit to worn tools or to new tool bodies requires careful technique to prevent cracking

speed steel deposit. The weld is started at the end, or tip, and run back to the sloping surface. After allowing the first bead to cool in still air or in an air blast to 200 F., the second and third beads are laid down with cooling between them. The rate of cooling should be regulated so that the deposit does not show red heat for more than 10 sec. after the weld is completed. Laying down the second and third beads while the deposit is still warm reduces the tendency for cracking. After cooling the tool is ready for grinding.

The building up of a worn woodworking blade is shown in Fig. 2. Here the beads were laid in full length as shown in the cross-section. Fig. 3 gives an example of building the deposit out beyond the edge of the tool so that certain dimensions can be maintained at the cutting edge. Beads were first laid down at the corners to increase the width and the remaining beads were put in according to the sequence numbered on the end view, Fig. 3. The piece was 1 in. wide and a ⅛-in. electrode was selected for the corner beads and a $\frac{5}{32}$-in. electrode for the two center beads. The center bead should overlap the outside beads, the latter merely serving to retain the deposit. Cracking after cooling as the result of improper tying-in of beads is illustrated in Fig. 4. At *A* the beads 1 and 2 may crack after bead 3 is deposited. It is better to apply the beads as shown at *B* or *C*.

Heat-treatment of Toolweld follows in principle that for high-speed steel. The main differences are lower hardening and drawing temperatures, and more effective means to prevent decarburization. Procedure is as follows: preheat to 1,400–1,450 F. and transfer tool immediately to the high-speed furnace. A reducing atmosphere is preferable. Heat the tool to 2,150–2,200 F. and hold at that range for a short time to insure solution of complex carbides. Quench in a light oil heated to 250–300 F. Then transfer to a drawing furnace maintained at 850–1,080 F. Annealing should be done in a container and at a temperature of 1,550 F. and cooled at the rate of 40 F. per hr. until 1,200 F. is reached when the container can be removed from the furnace and allowed to cool in still air.

Photographs were supplied through the courtesy of the Lincoln Electric Company, the manufacturer of "Toolweld" electrode.

Finish Not for Looks Only

T. E. STUART

While some parts of machines are usually finished all over for the sake of appearance, there are conditions where they may be finished for an entirely different reason. For instance, forged parts requiring maximum strength must be machined to the form and cross-section called for to attain maximum strength with minimum weight.

No better example can be offered than the main and side rods of locomotives. The main rods in particular are subjected to heavy stresses, not tensile and compression only, but bending stresses that may be particularly excessive because of high speed augmented by track inequalities, necessary or undue lateral movement of driving wheels, and pounding caused by too loose bearings, all of which are beyond determination when the design is under way.

It is well known that parts of this character that are subjected to reversal of bending stress must be free from flaws or tool marks at the point of maximum stress, for any break must have a starting point and even a crosswise scratch made by a scriber is sufficient to cause ultimate failure under repeated heavy stresses. Main rods should therefore be machined all over, all cuts being lengthwise. Drawfiling and finishing with abrasive cloth, making all strokes lengthwise and rounding sharp corners, is work profitably done.

Rods so finished should never be painted. If left bright, inspection is much easier and wiping with clean waste will often reveal an incipient flaw or defect. Rods should be handled in the shop in such a way as to prevent marring the finished surfaces. Such things as using them as anvils for straightening bent bolts or cutting out shims should call for severe measures of discipline.

Ideas FROM PRACTICAL MEN

Micrometer for Checking Shoulder Distances

CHARLES C. TOMNEY
Chief Tool Designer, Carrier Engineering Corporation

In making the crankcase illustrated in Fig. 1, it is necessary that the 23½- and the 12⅝-in. dimensions at *A* and *B* be held within the limits specified. The 5¼-in. dimensions at *C* must be held within 0.010 in. To check these dimensions the micrometer gage illustrated in Fig. 2 was developed.

The body *A* of the gage is made from steel tubing for lightness. The knurled handle *B* is turned to fit the tubing and is held in place by a taper pin. The cast-iron ring *C* is fitted to the large hole in the end of the crankcase. The center-bearing arm *D* is held in place by collar *F*. A similar arm *H* is attached to ring *C*. Both arms are fitted with micrometer heads, as shown.

In use, the gage is inserted through the large hole in the crankcase and the C-washer *I* is inserted between the knurled nut *K* and the end of the crankcase, and the nut is tightened by hand. The distance from the shoulder *L* to the C-washer is made 0.010 in. less than 5¼-in., being the allowable limit. If, when the nut is tightened, the gage is not rightly held, it shows that the dimension in the crankcase is too small. However, the 5¼-in. dimension in the crankcase is readily held much closer than is required because accurate stops are used on the boring bar.

The shoulder distances in the crankcase are checked by the micrometer heads, which are positioned to read 0.500 in. when the distances are correct. The gage can be rotated to bring the micrometer heads into different radial positions for checking the squareness of the shoulders.

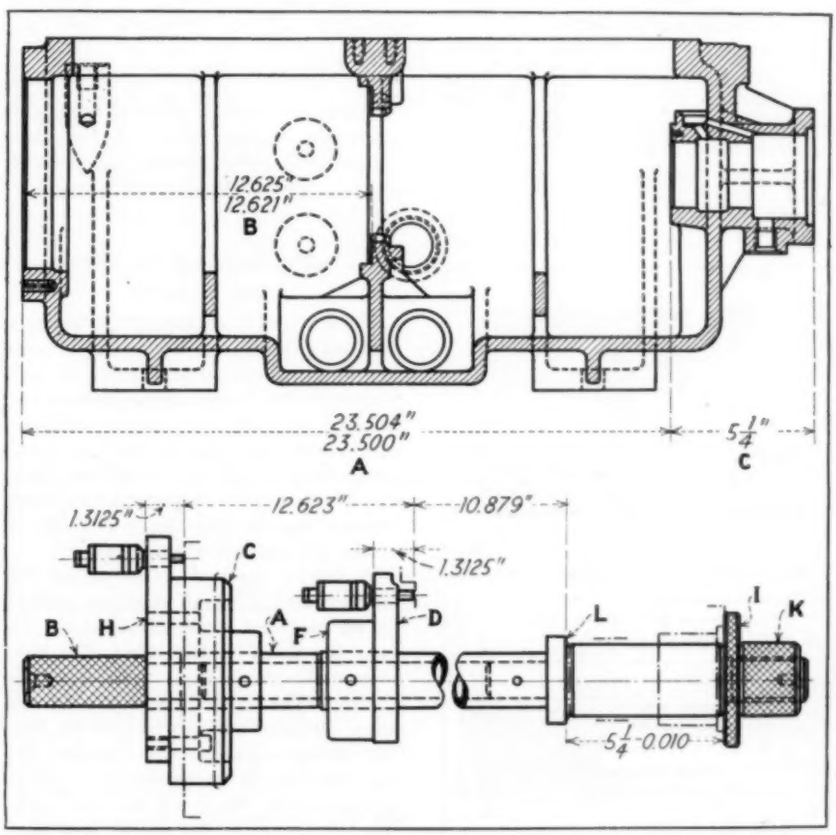


Fig. 1—The crankcase to be checked. Fig. 2—The gage is fitted with micrometer heads for checking shoulder distances. It can be rotated to bring the micrometer heads into different radial positions for checking the squareness of the shoulders

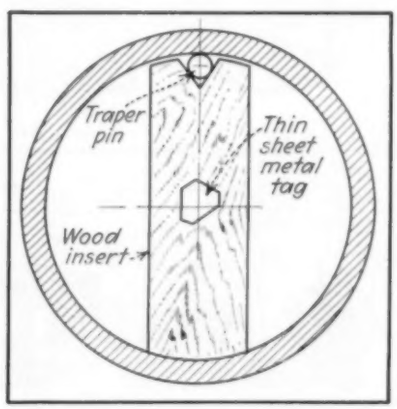
A Centering Spider Discussion

IRA S. WILLIAMS

The article under the title given above (*AM*—Vol. 79, page 375), by William M. Halliday describes a device for locating the centers of holes.

I have always found wood inserts satisfactory for that purpose. I cut a small V in one end of the insert and, after the insert is in place, drive a suitable taper pin in the V, as shown in the illustration. Then I cut a triangular tag of thin sheet metal, bend the three points at a right angle and press them into the insert so that the tag is approximately in the center.

After having found the center of the hole in the usual way, I prick-punch the tag as a center for one leg of the dividers. The same insert can be used repeatedly in holes of the same diameter. If the holes are cored, the taper pin takes care of any slight difference in diameter.



A tag of thin sheet metal having the points bent at a right angle and pressed into the wood insert is prick-punched as a center

Adjustable Plug Gages and Boring Bars

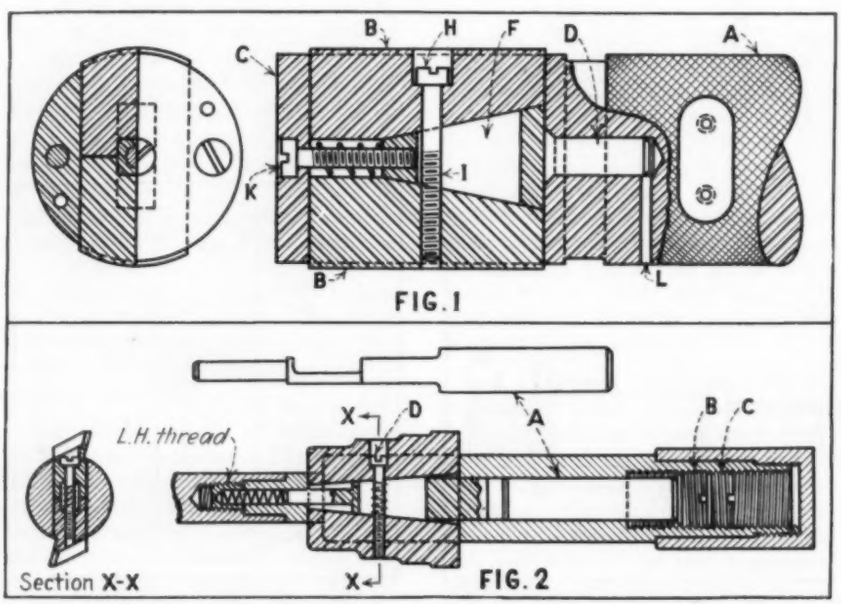
JOHN A. HONEGGER

In the adjustable plug gage illustrated in Fig. 1, a rectangular slot is milled in the end of the body *A* to receive the gaging shoes *B* and its open end is closed by the cover plate *C*. A hole is drilled at *D* for the pilot on the inner end of the adjusting wedge *F*. The wedge is slotted crosswise to permit the clamping screw *H* and the spring *I* to pass through it. The outer end of the wedge is drilled and tapped for the adjusting screw *K*. At *L* is a hole in the body connecting with hole *D* to prevent air from being trapped by the pilot on the wedge. The size of the gage can be stepped up by inserting gaging shoes increasing in increments within the range of adjustment.

In adjusting the gage for wear or to a larger size, the clamping screw *H* is loosened and the adjusting screw *K* is tightened to draw down the wedge and move the gaging shoes outward until the correct size is reached, as measured by a micrometer. When adjustment has been completed, screw *H* is tightened and holds the angular surfaces of the gaging shoes tightly against the wedge. Both screws are then sealed against tampering by pouring melted sealing wax into the counterbores of their holes.

In the boring bar illustrated in Fig. 2, the method of adjusting the cutters is similar to that of adjusting the gaging shoes in the plug gage, although the arrangement of the adjusting mechanism is slightly different. The adjusting wedge is integral with the pin *A* and is adjusted from the rear of the bar by the screw *B*. After the adjustment has been made, screw *B* is locked by tightening screw *C*. Then melted sealing wax is poured into the holes of locking screw *C* and clamping screw *D*, as for the plug gage.

The entire bar is only long enough to contain the cutters and the adjusting mechanism. The rear end is threaded and can be screwed into extensions of the required lengths. The pilot is screwed onto the reduced end of the bar and can be replaced by others of different diameters.



The gage is adjustable within certain limits. Its size can be stepped up by inserting larger gaging shoes. Adjustment of the cutters in the bar is similar to that of the gaging shoes in the plug gage

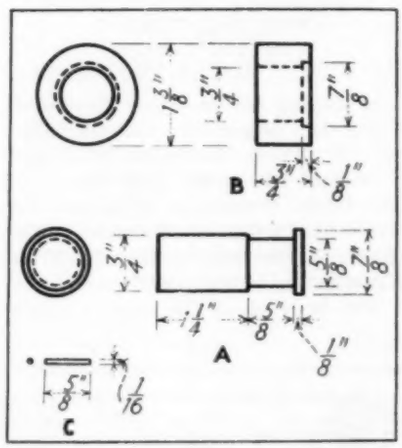
Non-Rolling Rollers

RALPH W. DICELY
Toolroom Foreman, Mac-It Parts Company

On our automatic screw machines we had considerable trouble from the cam rollers refusing to roll, causing flats on the rollers and undue wear on the cams. This caused variations in the size of the work and, of course, lessened production because of the time lost in replacing worn parts.

To overcome the trouble we made new cam roller studs, as at *A*, using the regular cam rollers *B*. In the recesses of the studs we placed rolls cut from ⅛-in. drill rod, as at *C*, making a roller bearing. For ease in assembly, the rolls were held in place in the recesses by rubber bands until the cam rollers were slipped over them far enough to prevent them from falling out. When the rubber bands were removed there was no trouble in pushing the cam rollers completely over the rolls. This makes what is really a needle bearing.

Both the studs and the rolls were hardened and drawn and the studs were ground to size. Since using the new studs we have had no further trouble from the cam rollers refusing to roll. The work has been more uniform and there have been less repairs and replacements.



Rolls cut from ⅛-in. drill rod and placed in the recess of the stud formed a roller bearing and reduced friction to the minimum

Truing Centers in Work

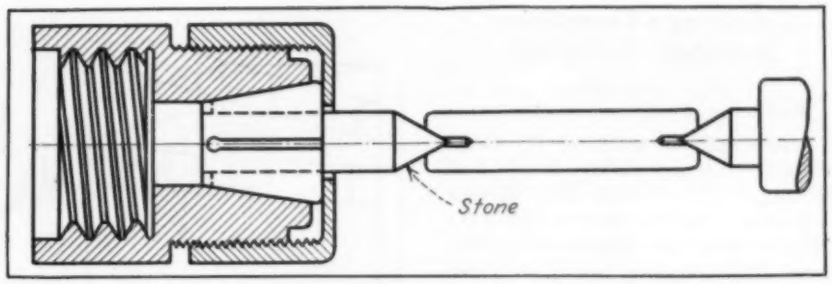
WM. C. BETZ

Work that is supported on centers and must retain its accuracy through long periods of service, such as test mandrels for inspection, mandrels for holding work in a cylindrical grinder, etc., must have centers that are more accurate in angle and roundness than can be made with a countersink. Such centers are usually finished with a metal lap charged with abrasive.

A better method is to stone the centers with a round oilstone pointed to an included angle of 60 deg. To turn the point on the stone, it is held in a collet chuck in a bench lathe, as shown in the illustration, and is turned by a diamond such as is used for truing abrasive wheels, the diamond being held in the compound rest. It is essential that the head and tail spindles of the lathe fit snugly and that they be in accurate alignment with the center line of the lathe. The tail spindle should have a lever feed, the joints of which should have no backlash. In

turning the stone to a point, the diamond must be set accurately to the center height of the lathe.

In stoning the centers of the work, the center at one end is held against the tail center and the center in the opposite end is fed to the stone by feeding the tail spindle with the hand lever. The work is grasped by the hand and is permitted to rotate from time to time to present new positions in stoning the centers to accurate shape and an extremely high finish. Kerosene is used as a lubricant. Any of the finer grades of manufactured oilstones is suitable for the purpose. The speed of the stone should not exceed 400 r.p.m. for the best results.



Where centers in work must be very accurate in angle and roundness and be highly finished, a round oilstone pointed to an included angle of 60 deg. can be used to advantage

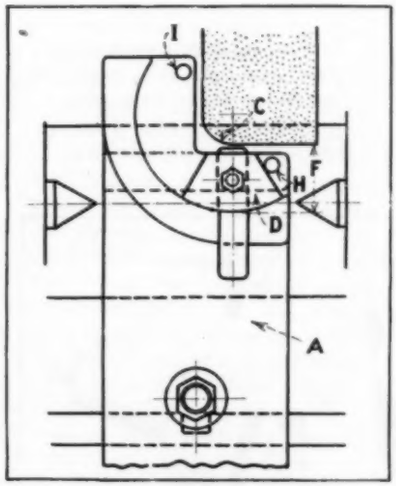
Radius Wheel—Dressing Fixture

LESTER J. LALIME

An inexpensive and accurate fixture for dressing the corner of a grinding wheel to a predetermined radius is shown in the illustration.

The body *A*, at one end of which there is a finished shoulder of known radius, is mounted on the table of the grinding machine. The oscillating member *D*, which also holds the diamond, has a machined surface of the same radius as that of the radial shoulder on the body.

To locate the diamond point for a predetermined radius, it is set from the radial shoulder on the body of the fixture a distance equal to that between the required radius and the radius *C*, as shown at *F*.



By setting the diamond correctly and moving the oscillating member between two stop pins, one corner of the grinding wheel can be dressed to a predetermined radius

In use, the rear part of the diamond mounting is grasped by the hand and is manually oscillated, being guided by the oscillating member *D* in contact with the radial shoulder on the body. The travel of the oscillating member is limited to 90 deg. by the stop pins *H* and *I*. The height of the fixture is such as to hold the diamond point at the center height of the wheel spindle.

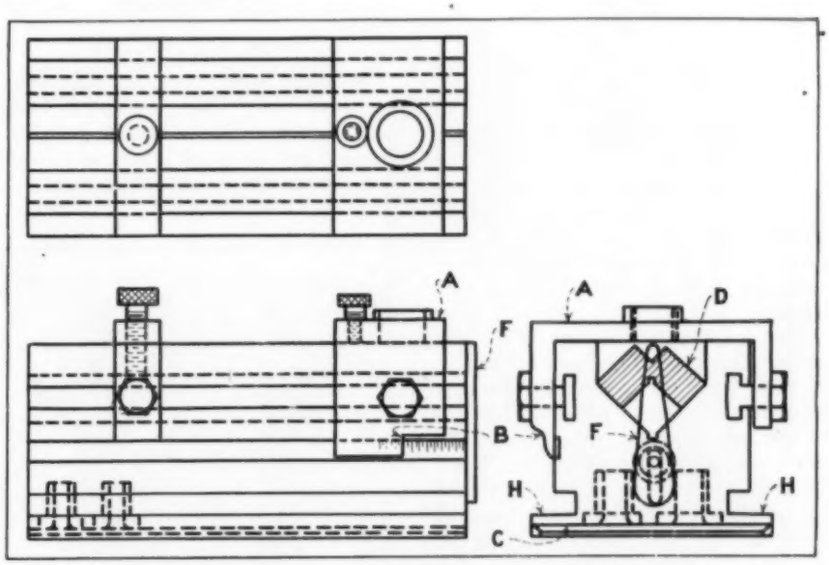
Jig for Drilling Cross Holes in Round Stock Discussion

MICHAEL AXLER

The jig illustrated is, I think, an improvement over the one described by H. A. Gilliland in an article under the title given above (*AM*—Vol. 79, page 436).

The base of the jig is a V-block and the sliding bushing plate *A* can be moved so that holes can be drilled any distance from the end of the stock within range of the device. The indicator and the graduations at *B* show the center distance of the bushing from the end of the work. Bushings having holes for various sized drills are stored in holes in the base and are retained by the sliding cover plate *C*.

One of the features of the jig is the auxiliary V-block *D*, which is provided for holding work of small diameter close enough to the lower end of the bushing to prevent the drill from running. In the position shown it will accommodate work from ¼- to ½-in. in diameter. By reversing its position it will accommodate work from ½- to 1¼-in. in diameter. By removing it and using the V-block in the base, work from 1¼- to 2½-in. in diameter can be accommodated. The stop *F* for locating the work can be swung out of the way by loosening its clamping screw. The jig can be clamped to the drill press table, the flanges *H* being provided for that purpose.



A feature of this jig is an auxiliary V-block for holding work of small diameter close enough to the lower end of the bushing to prevent the drill from running

Calipering a Three-Point Diameter—Discussion

O. D. BRADSHAW
Fredericton, New Brunswick, Canada

Referring to the article by H. Moore under the title given above (*AM*—Vol. 79, page 331), I think Mr. Moore's measuring tools are quite cumbersome and that their use opens a chance for error. If the turning tool is set above the center, as it should be on work of this diameter, some care must be taken each time to make sure that the wing is diametrically opposite the tip of the tool, and also to adjust the leg of the caliper on the tool tip.

A much simpler method would be to bore the central hole first and then set a pair of calipers to one-half the outside diameter over the wings, minus one-half the diameter of the bore. Then, all that would be necessary to caliper the work would be to put one leg of the caliper in the bore opposite to one of the wings and to caliper over that wing. However, if Mr. Moore prefers to caliper from the tip of the tool over one of the wings, he should use an odd-leg caliper, which is a self-contained tool and more sensitive to the touch.

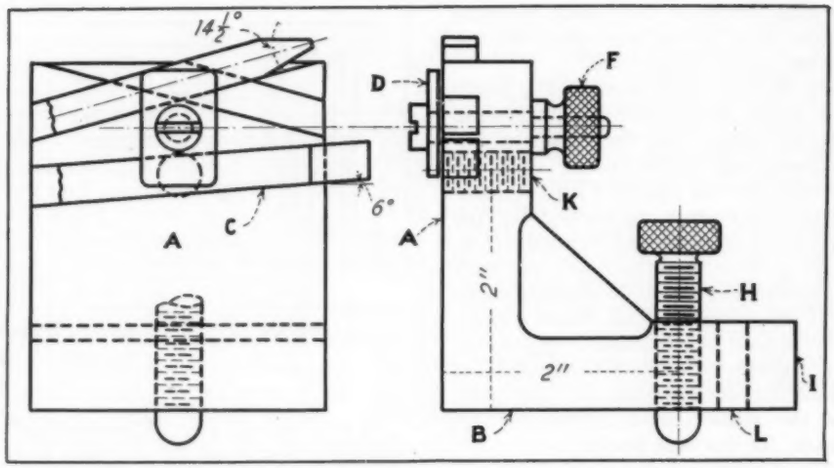
On production work of this kind, a dial indicator is sometimes used, being set to read zero when swung against a permanent stop. Since the zero reading would show when the correct diameter had been reached, any reading above zero would show one-half the amount to be taken off of the diameter, or the amount to set in the tool for the cut.

Fixture for Grinding Thread Tools

ARTHUR F. PARKER
University of Michigan

A research project recently completed, required chasing some rather accurate threads on a quantity of test pieces. For grinding the threading tool, the fixture illustrated was designed.

The body of the fixture is a toolmaker's knee, in which slots are milled in both faces for holding the toolbits at the correct thread angles. The slots in the face *A* are at an angle of 14½ deg. for holding toolbits for Acme threads, while those on face *B* are at an angle of 30 deg. for standard threads. The slot *C* is for grinding the flat and the front clearance angle at 6 deg. The toolbits are held in the slots by the clamp *D* and the knurled head screw *F*.



Toolbits held in this fixture can be ground to the thread angle, the helix angle and the angle of front clearance, including the flat at the point

The knurled head adjusting screw *H* is for tipping the fixture for grinding the side clearances for the helix angles. It is located a definite distance from the face *A* to simplify the computations for the various settings, the most frequently used of which are stamped on the edge *I*. The tapped hole *K* is for the adjusting screw *H* when the fixture is used with the face *A* resting on the face of the machine table, in which setting the clamping screw is put into the tapped hole *L*. In grinding the sides of the toolbit for the helix angle, 6 deg. should be added for actual clearance.

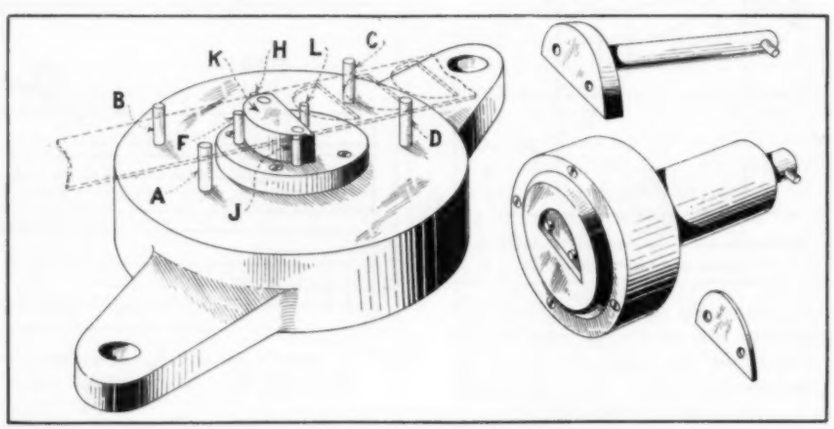
Pins as Guides and Strippers

CHARLES H. WILLEY

In many press tools for short runs on small parts, where automatic feeds and stops are not warranted, pins can be used both as stock guides and strippers, as shown in the illustration.

The guide pins *A*, *B*, *C* and *D* are so spaced as to clear the upper die and serve as a guide for the strip or roll stock. The pins *F*, *H* and *J* serve as a stripper and are actuated from below by a pressure pad. The tops of these three pins are normally flush with the top of the punch *K*. The stop pin *L* is a disappearing pin and the stock is fed against it from left to right.

We have many press tools that are used for short runs equipped with such pins. While the jobs can be done cheaper with tools arranged for automatic blanking, for the many short runs often made to suit sales, these tools are worthwhile and the saving in cost over tools having spring stop levers for spacing the stock and solid machined strippers, is considerable.



In these inverted press tools, four pins serve as a guide for the stock and three pins as a stripper. One disappearing pin serves as a stop

Shop Equipment NEWS

Kling Heavy-Duty Hydraulic Snag Grinder

Heavy-duty grinders designed to snag gates and risers on manganese-steel and gray-iron castings are offered by Kling Bros. Engineering Works, 1300 North Kostner Ave., Chicago, Ill. These machines are distributed nationally by the Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.

The work is fastened to a T-slotted, horizontal work-table which travels parallel to the face of the wheel under hydraulic power. The wheel is operated in a vertical plane by hydraulic power. Feed of the work against the wheel is accomplished manually. The work table measures 36 in. x 48 in. and has a power travel of 24 in. It is also provided with a 7 in. manual cross-travel or feed for bringing the work into contact with the wheel.

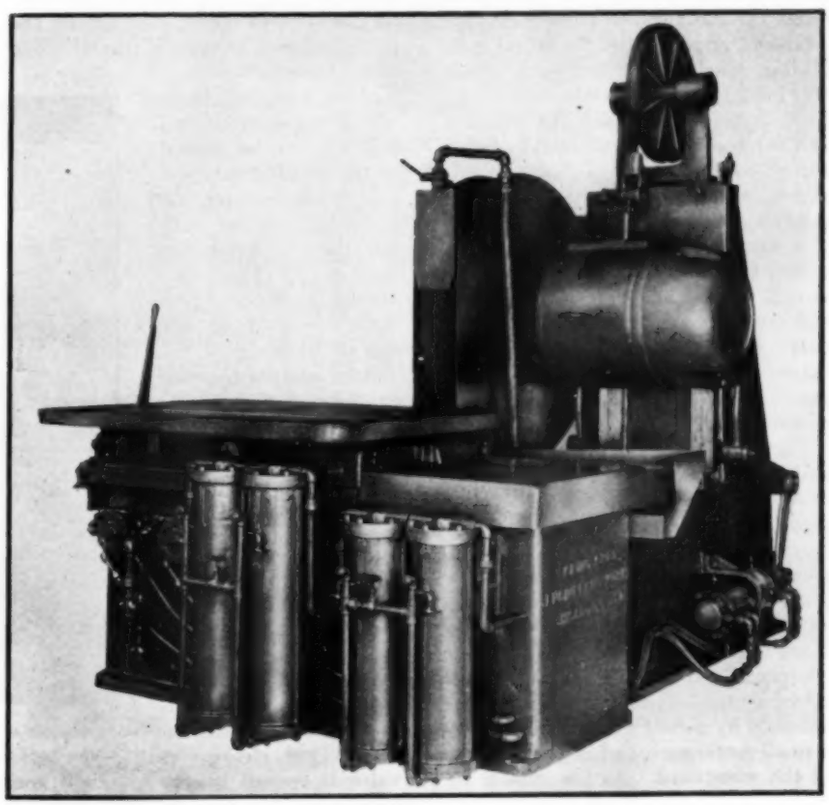
Bolted to the bed is a hollow column with ways machined vertically for the motor carriage, which slides up and down the column with a vertical travel of 14 in. The motor is rated at 30 hp., 900 r.p.m. The wheel is mounted directly on the motor shaft and measures 40 in. in diameter, 5 in. face and 12 in. bore. Surface speed of the wheel is 9,300 ft. per min. Cooling water is piped to the work and is drained from the bottom of the wheel guard to a settling tank from which it is recirculated.

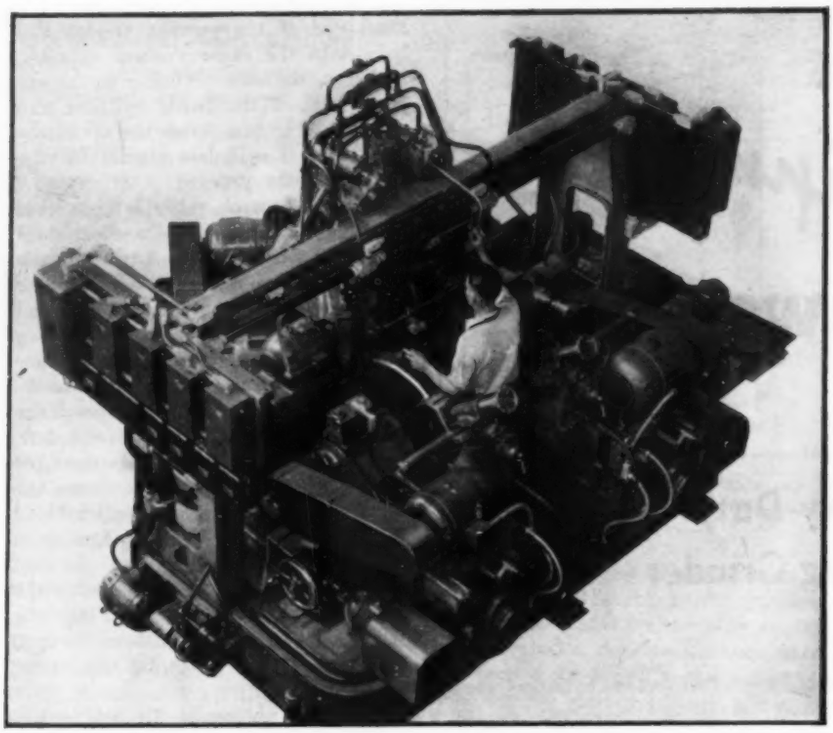
Mechanical and hydraulic features of the wheel and table travels are essentially the same. The table-drive mechanism is as follows: In a horizontal position beneath the table is a hydraulic power cylinder, the double-acting piston of which is connected to the table. Mounted on the side of the machine are two vertical cylinders, each feeding oil to one end only of the power cylinder. Air from the shop line is taken to the tops of the vertical cylinders, each of which contains a free piston. These cylinders are filled with oil to about two-thirds of the height. Oil chambers are piped to a duplex control valve that permits oil to flow from the cylinder to say the head end of the power cylinder and back into the same vertical cylinder, and from the other cylinder to the opposite end of the power cylinder and return. A bypass levels the oil in the two vertical cylinders should leakage occur past the pistons.

The oil control valve is connected by flexible couplings and a short shaft to an air valve which controls the air to the vertical cylinders. The throw of this lever can be regulated so that the table speed can be either slow or fast in both directions, or slow in one direction and fast in the opposite direction. On each side and beneath the air valve are two small air cylinders, controlled by adjustable dogs mounted on the side of the table, to throw the air valve which controls the length of table travel. This travel ranges from 24 to 1½ in. per min.

Power operation of the wheel is the same as for the table except that the wheel power cylinder must act through a bellcrank and links to the motor carriage.

With the automatic up- and down-movement of the wheel and the table movement across the wheel, the operator has only to operate the feed and to force the work against the wheel. Maximum speed of the table is seven complete strokes per min., and that of the wheel is four complete strokes per min.





Cincinnati Unit Center Type Grinder

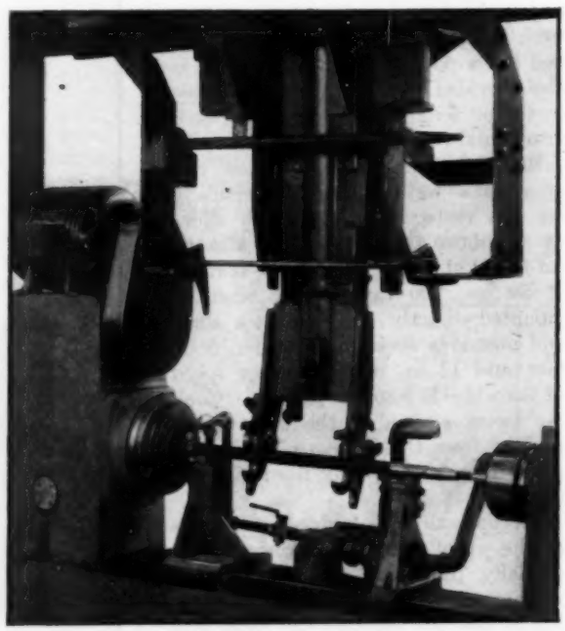
A special-purpose machine that by means of unit construction may be adapted to change in design of the manufactured product is one of the recent contributions to high-production precision grinding by the Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio. Although the set-up was designed for grinding four surfaces on automobile axle shafts, plunge cutting operations may be carried on either singly or in multiple on a variety of work carried between centers. Operation, however, must be on a quantity-production basis, for although the machine is of the unit type and can be changed over to accommodate reasonable changes in work shapes, it would not be economical to consider making this change-over at periods less than 600 working hours.

The wheelheads on this machine are built-up in units and are equipped with 30-in. diameter grinding wheels. Hydraulic truing arranged for either rotary or diamond truing tools is supplied for each grinding wheel. The lower unit consists of a base upon which a sub-base slides on dovetails. Upon the sub-base is mounted the wheelhead carrying the spindle. Power infeed motion of the grinding wheel is obtained by a cam which is rotated by a small motor mounted in the sub-base of the wheelhead. As the cam is rotated the wheelhead tilts about a pivoted bearing. Compensation for wheel wear is obtained by means of a handwheel to the wheelhead base and by push-button control. Each time the push button is depressed, the grinding wheel feeds in 0.0001-in. Each wheelhead assembly is a self-contained unit and can be applied singly or in groups. A spindle reciprocating attachment can be built into the wheelhead. The coolant system embodies a gravity feed tank mounted on the top of the bridge.

As a safety precaution in the operation of the unit, the various control mechanisms are interlocked. The wheelhead motors cannot run until the pump and headstock motors are running, making it impossible to grind work unless it is rotating.

An axle is placed on a loading cradle in position to be picked up by the loading attachment on its upward stroke. A valve is opened by the operator, admitting oil to the top end of a cylinder and causing the loading slide to move down. The slide deposits the work on two V-block, which hold the work approximately $\frac{3}{32}$-in. below the line of centers. Continued travel of the slide opens a valve, causing the headstock and footstock to move into the work. Full pressure of the hydraulic system is received by the footstock cylinder, causing the footstock center to move in rapidly and lead the headstock center by a short interval, preventing the facing wheel from contacting the work until it is properly supported and located endwise. The work is picked up from the V-support block through the wedge action of the centers, and caused to rotate by means of teeth in the headstock drive plate engaging the teeth in the bevel pinions which are cut integral with the shaft.

The cycle of operation, as performed in the axle-shaft application, is as follows: the operator places the axle on the loading cradle and throws a single lever to start the machine; the axle is lowered to the working position and picked up by the centers. The action of the centers moving in causes the closing of the two limit switches which start all four of the grinding wheelhead cam drives. The grinding wheels are moved in to the proper depth, allowed to dwell and then withdrawn. Final retraction of the grinding wheel opens a set of limit switches on each wheelhead which closes the complete electrical circuit, operating a hydraulic valve that retracts the centers, then



An axle shaft has been deposited in the V-blocks by the loading mechanism, which on the return stroke will grasp the shaft resting in the cradle above

the work is lifted hydraulically to an unloading chute.

When operating under production conditions, the cycle is automatic, four surfaces being finished complete from the block, with a production of 80 axles per hour.

Durez No. 2260 K Black Molding Material

General Plastics, Inc., North Tonawanda, N. Y., has announced the No. 2260 K black Durez phenolic molding material for larger moldings of the deluxe type. Impact strength of the material is approximately one-third greater than the general run of phenolic molding compounds. Because of this and because of the excellent finish obtained, the plastic material is finding applications for instrument cases, adding machine housings, typewriter parts, boxes and containers to withstand rough usage, as well as decorative objects. It has a compressive strength of 29,000 lb. per sq.in., a heat resistance of 400 deg., and weighs 22.2 gms. per cu.in.

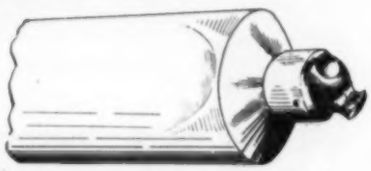
Philadelphia Proportional Gas-Air Mixer

The Philadelphia Drying Machinery Co., 3351 Stokley St., Philadelphia, Pa., is now offering a proportional mixer to maintain constant gas-air ratio in burner applications. The device consists of a diaphragm-actuated control valve known as the "Zero Governor," which feeds gas at atmospheric pressure to an inspirator into which the gas is drawn and mixed with air. Because the gas enters at a constant pressure, the amount of gas inspirated is directly proportional to the quantity of air flowing through the device, causing the two to combine in constant, unvarying ratio. Regulation is by means of a valve controlling the rate of gas flow to the inspirator. The governor is said to be lag-free.

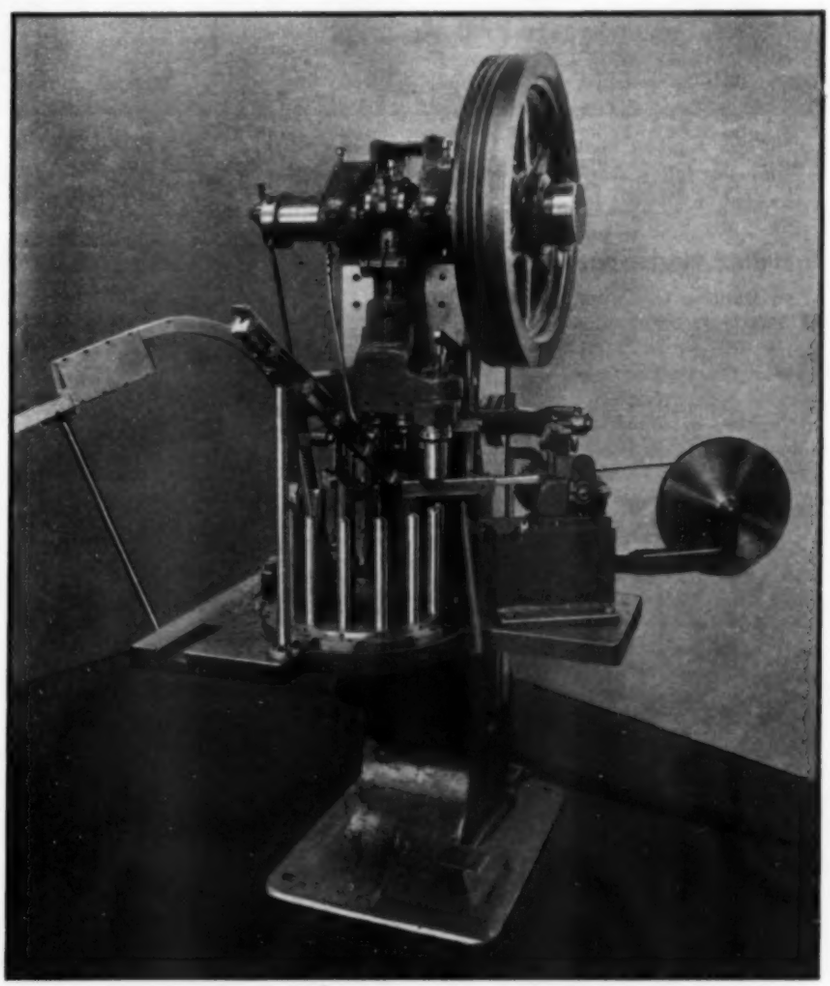
V. & O. Ball Cap Machine

A machine, designated as the No. 41, for the production of tube containers with a ball top which eliminates the annoyance of the screw-type cap has been announced by the V. & O. Press Co., Hudson, N. Y.

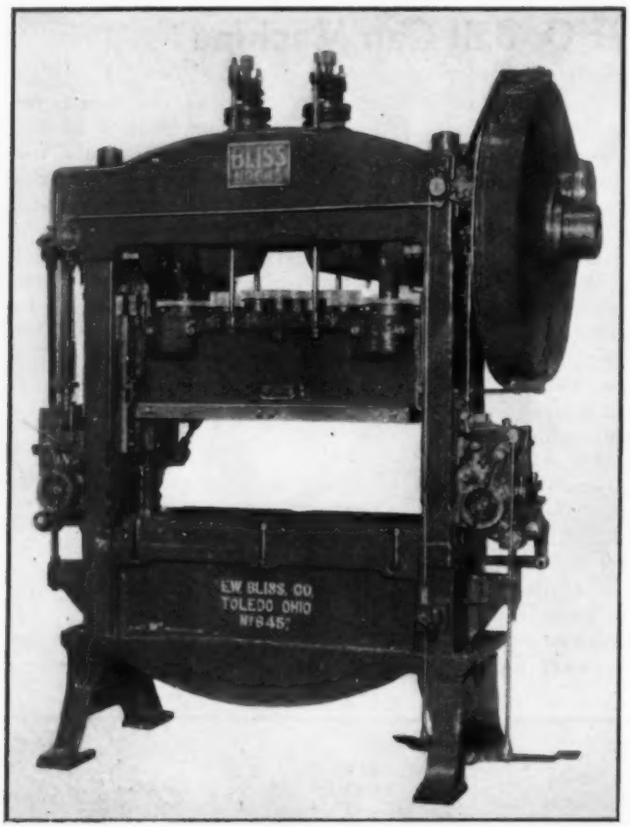
The machine is built on the modern dial principle of assembling machines and completes the four operations necessary to install the bakelite ball cap in one revolution of the table. A feed belt conveys the hollow tubes to the machine and places them one at a time on the fourteen hollow mandrels arising from the dial. As the table turns counter-clockwise, a gasket of bond paper impregnated with rubber is inserted in the mouth of the tube. Strip material for this gasket is fed from a reel through a roll feed to the punch which punches out the gasket. A ball cap, having small indentations on diametrically opposite sides, is then placed in the top. Sides of the throat are pressed into the indentations in the ball, forming an axis upon which the ball turns. As the dial moves on the flange is rolled around the ball seating it in position. On completing the revolution, the tube is shot from the dial by a blast of air through the hollow mandrel and slides down a chute to the packing table. Production on this machine is 50 tubes per min.



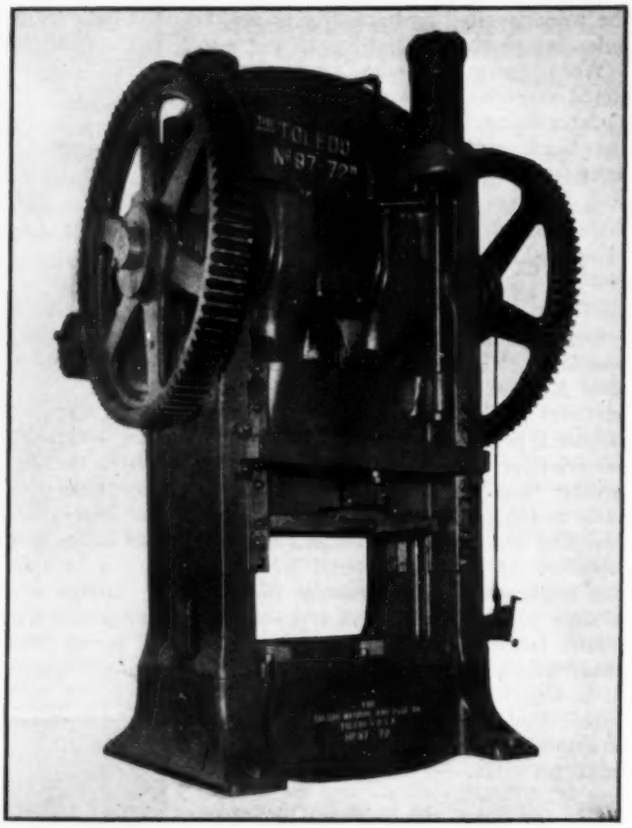
Neck of the tube is rolled around the molded closure device and two indentations hold the ball on its axis of rotation



Four operations in the assembly of a patented collapsible tube closure are carried out on this V & O No. 41 press with special equipment



Width between housings of 48 in. adapts this Bliss press to follow dies of considerable length. Operating speed is 250-300 strokes per min.; rating 45-65 tons



Toledo No. 97 Twin Driven Press redesigned for smooth contours. Alloy castings and shrunk-in steel rods protect the press from overloading on heavy bottoming operations

Bliss High-Speed Press

An addition to its line of high-speed automatic presses is announced by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio. The press has a width between housings of 48-in., adapting it to the use of follow dies of considerable length. It is regularly rated from 45 to 65 tons, depending upon the character and duration of the load. A multiple-speed drive makes available operating speeds up to 250 or 300 strokes per min. for the non-geared machine, and up to 150 or 175 strokes per min. for the longer-stroke geared machine, for drawing operations of appreciable depth.

Heavy sections, special accurate gibbing, the double-crank construction with heavily ribbed crown and the shrunk tie-rod frame contribute to long die life. Equipment includes: high-speed double-roll feeds, scrap shear with blade clearance adjustment, spring counterbalance for the slide, automatic force-feed lubrication and a foot-controlled starting mechanism. The latter is essential for efficient production on strip feeding and is a convenient feature in starting and re-starting coil stock.

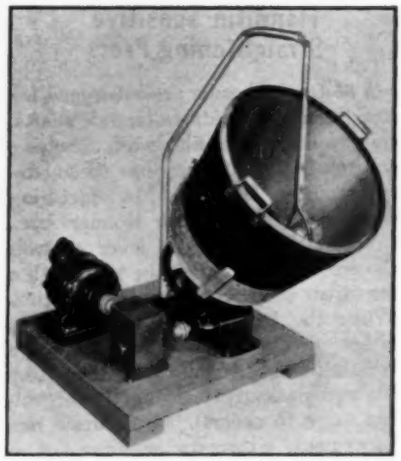
Walker Welding Hood

The Walker Welding Hood, introduced by E. D. Bullard Co., 275 Eighth St., San Francisco, Cal., is available in two styles. The "Slide Front" style has the smoked horsehide hood suspended from a light weight head frame. The frame holds the hood from three to 4 in. away from the head, thus affording ventilation and comfort. Head bands are added for comfort and are adjustable for size.

The "Tilt Front" style is for work in close quarters, having no frame so that the hood rests snugly on the head. These hoods give protection to the eyes and eliminate reflected light.

Toledo Punch Press

The Toledo Machine & Tool Co., Toledo, Ohio, has redesigned its line of presses to smooth out the contours and to eliminate corners and dust pockets wherever possible. While this work necessarily improves the appearance of the equipment it also increases the strength of sections through the use of ample radii. Frame members are of high test alloy castings. The high modulus of elasticity obtained in the alloy castings affords greater stiffness of the bed and slide members than in the past. Shrunk-in steel rods are designed to protect the press from overloads on heavy bottoming operations. The press is equipped with a mechanically controlled, self-adjusting pneumatic friction clutch. The fast action of this clutch permits considerable increase in the production rate. Also included in the equipment are pneumatic counterbalance cylinders, a crossbar knockout in the slide, and a direct-connected liftout in the bed.



Udylite Handiplater

The Udylite Co., 1651 East Grand Blvd., Detroit, Mich., has developed a plating unit, known as the "Handiplater," designed for plating occasional small lots or for production plating of small parts. A detachable cylinder makes possible the use of any barrel plating solution in the same cylinder. The anodes are held in a small basket suspended from an arm over the bell. To change from one type of plating to another, the cylinder is rinsed with water to remove the former solution and the anodes are replaced by those desired. After plating, removal of the anode basket and solution converts the cylinder for drying or tumbling. Cylinder capacity is 25 lb. The unit is motor-driven, powered by a ½-hp. motor.

Walker Type MC Swiveling Magnetic Chuck

This chuck, developed by the O. S. Walker Co., Worcester, Mass., is arranged for locating 90 deg. for retruing the top face, and to intermediate angles for grinding bevels on machine knives. It can also be rotated 20 deg. in an opposite direction. Both faces have T-slots for locating or clamping work. The magnetic surface on the face of the chuck is 7¼ in. wide, and on the top is 6¾ in. wide. This magnetic surface is uninterrupted over the edge of the chuck for the entire length of 14 in.

In this Type MC chuck the coils are placed 6¼ in. between centers. Therefore, they can be supplied only in lengths varying by 6¼ in. Chucks of this type can be built in single units up to 10 ft. in length. Above 10 ft. they are made in three units, the center section being 77 in. long. End sections of equal lengths are welded to the ends of the center section which, with a continuous backplate, makes the chuck a single unit. Magnetic surface to 206 in. are available.

The chuck is of triangular cross-section and all-steel construction, except for the bearings and central control unit. End bearings have bronze sleeves and pillow blocks having end caps and felt wipers to prevent water from entering the bearings. The bearings may be clamped when the chuck is in the desired position. The central control unit has a bronze gear segment attached to the back of the chuck. This segment provides support in its bearing under the back of the chuck, thus maintaining correct alignment with the end bearing.

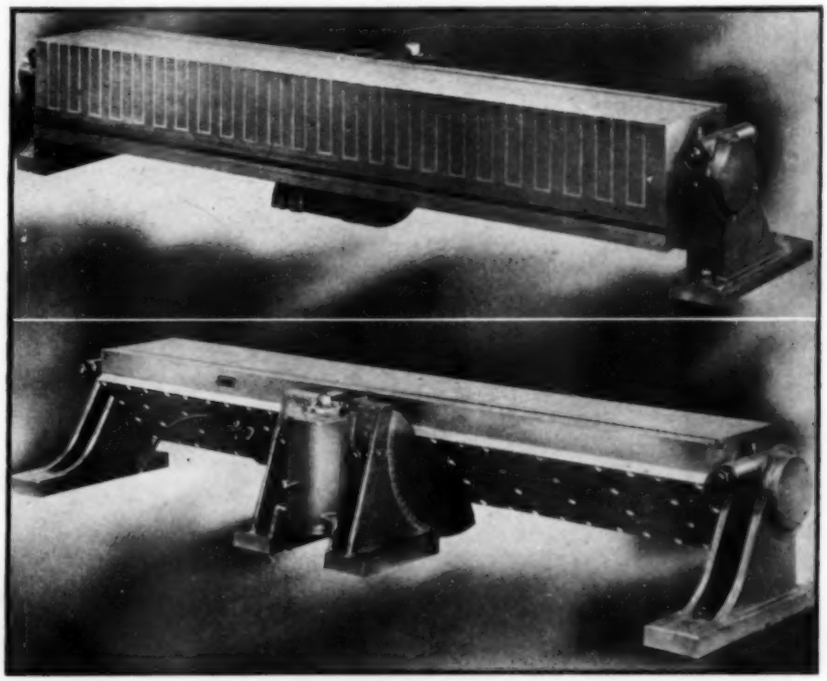
Rotation of the chuck is accomplished by a hand wheel, not shown, which operates the vertical shaft carrying a steel worm that engages with the bronze ring gear. A canvas guard which can be placed over the unit when the hand wheel is removed, protects the center control from water and grit.

Similar construction is also available for non-rotating units, the chuck being mounted on angle supports which are substituted for the pillow blocks and center bearings. Chucks used in fixed positions can be built in independent units and the proper alignment is obtained through location of the supporting angles.

Quality Metal-Marking Tool

The Quality Die Co., South Chicago, Ill., has announced the introduction of two types of metal-marking devices. One contains all the letters of the alphabet and the numerical digits from 1 to 0 on a single wheel. A single character is impressed at a time, but by turning the wheel any combination of figures and letters may be stamped. Accuracy in stamping is secured by a guide opening in the face of the tool, through which appears a duplicate of the character to be impressed. Grooves in the base serve as guides for the placing and aligning of characters.

The second marker is a multiple wheel device. It is supplied with any number of wheels, and each wheel contains ten, twelve or fourteen characters, either figures or letters, or both if



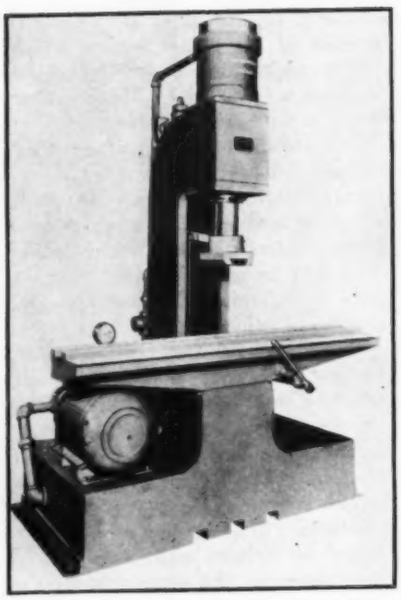
Front and rear views of the Walker Type MC Swiveling Magnetic Chuck show the two magnetic faces and the swiveling mechanism

desired. Special characters can be engraved to order. Grooves cut into the face of the wheels between the characters fit over a small pin which insures alignment and acts as a reinforcement to the large shaft pin. Characters are kept in alignment by means of ratchets for each wheel. Impressions may be made on metals with hardness up to 415 Brinell.

Frank Tube Bending Machine

The Frank Automatic Bending Co., Inc., Second & Elm Sts., Cincinnati, Ohio, has developed a power-driven bending machine for copper, brass and aluminum tubing from ⅛ to ½ in. The tubing can be bent in a horizontal or vertical plane in one continuous operation. The machine may be adapted to bending of various shapes within reasonable bending limits. Rectangular wire can also be coiled edgewise. Weight of the machine is 3,000 lb.

The tubing is fed into a straightening unit to take out any small bends that may be developed in the handling of the tubing prior to the time that it is ready for the machine. After passing through the straightening unit, it is gripped by a continuous conveyor, which in turn pushes the tubing through a bending unit which is automatically oscillated by means of a cam mechanism. Neither the conveyor nor the bending unit will crush, kink or split the tubing.



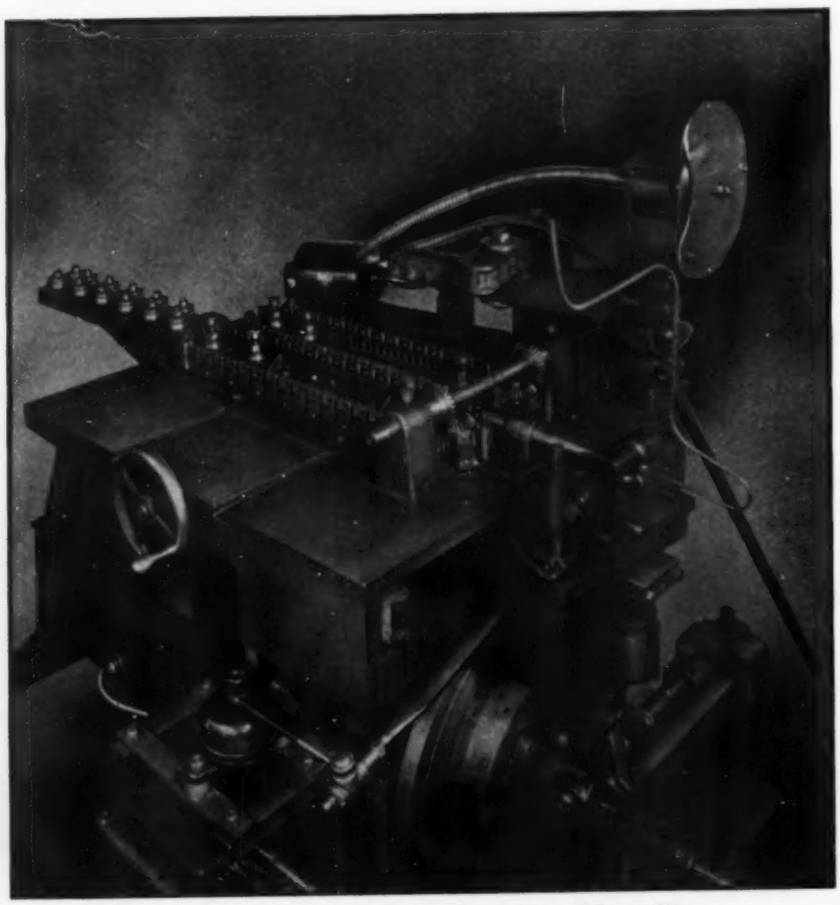
Hannifin Sensitive Straightening Press

Hannifin Sensitive Straightening Press

A 35-ton hydraulic press designed for straightening operations on axle shafts, crankshafts and similar work requiring accurate straightening has been developed by Hannifin Manufacturing Company, 621-31 South Kolmar Ave., Chicago, Ill. A single lever controls the entire operation of the ram, with a sensitive proportional control action. When the control lever is moved in either direction the ram will move a proportional distance and then stop by automatically bringing the operating valve to neutral. An accurate ram movement, either up or down, of as little as $\frac{1}{32}$ in. may be obtained. The arc of movement of the control lever is approximately three times the ram stroke, providing for sensitive handling.

The hydraulic power unit, with constant-delivery rotary pump, is built into the base of the press, making a self-contained unit that requires approximately 19 sq.ft. of floor space. No separate hydraulic power is required, which is instrumental in saving floor space.

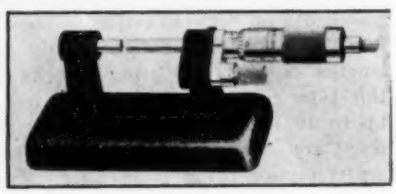
The ram delivers 35 tons pressure, and may be fitted with any type of fixture required for handling the parts to be straightened. The ram stroke is 6 in. Speeds are: power stroke, 53 in. per min., return stroke, 77 in. per min. Dimensions are: table to ram (up) 20 in.; center of ram to face of frame, 9 in.; length of table, 70 in.; floor to table, 36 in.; overall height, 98 in.; base, 38½x69 in.



Small tubing is bent on the Frank machine without filling

Brown & Sharpe Bench Micrometer Caliper

The Brown & Sharpe Mfg. Co., Providence, R. I., has announced the inclusion in its line of a No. 240RS, bench micrometer caliper for inspectors, watchmakers and manufacturing jewelers. The instrument reads to ten-thousandths of an inch direct by an auxiliary thimble and has a range of measurements of 0 to 1 in. Parts of ten-thousandths can be estimated readily. The base is rigid and heavy to prevent the tool from being upset. It is furnished with a ratchet stop.



The Round Table

A FAIR PRICE

"What's the trouble, Al? You look worried or something."

"I guess I am, Ed. It's sort of foolish perhaps, but I can't seem to help it."

"What's it all about?"

"A question of prices, Ed. Not on compressors, particularly, but on things in general."

"Is some one charging us too much?"

"I'm not sure whether it's too much or too little. I'm wondering if anyone knows what a fair price really is?"

"Whoever heard of worrying whether a price on what you buy is too low? What's the case in point?"

"The special fixture for that new impeller, Ed. We sent out blueprints to four good tool shops. I know them all, and they're really good. But the difference in the bids has me guessing."

"Nothing new in that, Al. There's always a wide variation. Take the low bid and call it a day."

"It isn't only these fixtures, Ed. It's almost everything we buy. No one seems to know what a right price is. If the low price is right, the high bid is robbery. Yet I know that the high bidder is as square a shooter as there is in the game.

"Then the low bidder must be crazy and likely to lose his shirt, Al."

"You'd think so, of course. But it happens he's been in the business longer than the other man."

"He must have some short cuts the other man hasn't heard of, Al."

"No short cuts can account for that much difference in bids, Ed. They must do an entirely different kind of bookkeeping. I don't know which is right."

"They say you get just what you pay for. Maybe the high bidder will do the best job."

"Of course, it should be that way, Ed. But you know that products being 'worth what you pay' is all bunk. You were bragging the other day about getting a discount on that new radio. Would it have been any better if you'd paid full price for it?"

"It seems to me you're getting all upset about nothing, Al. Why worry so much about the cost?"

"That isn't the point. I'm asking myself how we know enough to set a fair price on anything when similar shops put such widely different prices on the same job? It's the same in buying tools of any kind. The price varies considerably and in many cases up to 25 or more per cent."

"You don't expect everyone to figure alike, do you?"

"A lot nearer alike than they're doing now, Ed. How do we know we are setting the right price on our compressors? Just how should we figure the various items of overhead? Labor and material are easy. But I'd like a lot more light on setting prices that are fair to us as well as fair to everybody else."

Why do different quotations on the same job vary so much? Is poor estimating or faulty accounting the chief cause?

DISCUSSION

Fine Feathers

If a good paint job doesn't do anything else it attracts attention. In an exhibition of pumps, certainly the one that was most attractively painted would get first attention, and that would open the way to further investigation. While we buy machines on performance, we need advertising, and certainly a good paint job is a good advertisement.

Anyone who has exported machines knows that paint counts. In fact, when we have occasionally exported a rebuilt machine, the customer has always specified a first-class paint job. If it is demanded in foreign countries it will at least pay for the extra effort at home. Besides, a nicely finished job gives the boss and his help a certain pride, the effect of which is not to be sneezed at. In case of an agreed-upon color, like machine tool gray, the thing to do is to use the prescribed color, but even then the job can be either first-class or sloppy. —J. C. P. Bode.

Fine feathers don't make fine birds, but industry is fast learning that fine feathers have their use. Look through any issue of *American Machinist* and notice how all machine manufacturers are dressing up their products. Quite a number of them hire consulting engineers to improve their appearance. Practical men, especially machinists, want a good-looking job, even if it doesn't improve the quality of the work.

Even inartistic truck drivers doll up their trucks with brass balls, pennants, etc. As further proof of the value of a bright, trim, new-looking machine, read the experiences of several managers of plants that painted dingy machines with pleasing colors. They report that operators take more interest in keeping the machines clean and new looking, and a clean machine is almost invariably a well cared for machine.

Look around in your shop and you will find that the neat, clean workman always impresses you as a topnotch operator, and in the same way neat, clean machines impress prospective customers as topnotch machines, ones in which the manufacturer takes pride and which he can be proud of owning and his workmen be proud of running. So fine feathers may not make a fine bird, but fine feathers on any bird make a better bird.

—Bernard Shereff,
Standards Department,
American Hard Rubber Company.

Share the Wealth

For any government to create and hand out money of any kind, without assuring that additional values to the same extent will be created, is bound to lead to disastrous results.

We need to make up our minds as to what we really want and need, and then forget all isms, dogmas and half-baked theories and devise a system that will give us what we desire in the way of economic procedure.

Do we want unemployment insurance, or do we want employment assurance?

Do we want employment, or do we want an employment bureau?

De we want a chance to pay our debts, or do we want somebody to carry our notes?

Do we want an ism, or do we want freedom and independence?

Do we want a labor union, or do we want a reasonably fair distribution of earned income and a reduction in overhead?

Do we want to gamble everything worthwhile against a flimsy chance that we may strike it rich and never have to work, or do we want to be assured that every able bodied person will at least have the opportunity of doing his share of the world's work and receive a just reward for his services?

Our worst enemies are those capitalizers on distress who have seized the breakdown in the economic system as a means of promoting selfish and political desires. Although they crusade as friends of labor and the downtrodden they merely stir up false hatreds and distract the people's attention from the real issues, offering little except a few pounds of flesh. By such means they are able to prosper.

—Rupert L. Usrey.

So Ed and Al have decided to discuss social problems. I have always held that our engineers would eventually solve our economic problems and help usher in an era of liberty and justice. However, I feel that Al and Ed have been so interested in talking shop that they have failed to acquire a sound knowledge of our social system.

When H. A. Harvey, of armor plate fame, was asked if in attacking difficult problems he did not first look up what others had done in that particular line, he said that he solved the problem in his own way first and then looked up what others had done. He said if he had first looked up what others had done he would have fallen into a rut he would be unable to get out of.

I would suggest that instead of studying the works of master minds, Al should outline a plan how, in his opinion, the citizens of a civilized country should own and govern their country. I have suggested the study of ownership because it lies at the root of all social development. It is thought-provoking and will lead to the study of our progress through other economic systems, and how and why humanity has had to go through so many stages before arriving at our present state of civilization. —Samuel Gahan.

Al is correct in his contentions that idle wealth tends to vanish into the hands of others, and that the capitalist is forced to use it in order to keep it.

In each succeeding generation there have been some who try to hold on to the major share of profits instead of reinvesting the proper amount in the business from which it came, in the form of more modern equipment. Just as virtue is in itself a reward, such hoarding is in itself a disciplinary power, and those who practice it soon lose their places in the industrial parade.

Money obtained without effort is always contributory to both physical and moral decadence, and most of us realize this fact and are willing to put forth our efforts to earn a livelihood, even though, like Ed, we are human enough to want to be on hand if and when easy money is being passed out. Most of us realize that anything smacking of so-called equal distribution of wealth would indeed be a crude deal. —John E. Hyler.

Group Training

Al's idea for training men who are now on relief, appears to be a scheme for getting something for nothing. The right attack at this problem is the training of youth. That can be accomplished by properly supervising trade schools subsidized by industry or the government, or jointly by both. The last year of training should be under actual production conditions in one of the plants in the vicinity of the school. With such a system, the boy will be taken into industry with training and knowledge that can be capitalized within a few years.

Why beat about the bush by trying to cover up our mistakes in haphazardly training material that may or may not be a success? The real answer to the question is the training of youth, having a carefully planned objective. At best, the plan suggested by Al is just an expedient.

Some parts of industry have already seen the handwriting on the wall and are overcoming their particular problems. But why let a few far-sighted leaders carry the burden that should be equally borne by all concerned?

—Harold L. Wynn,
Executive Engineer,
Pacific Electric Manufacturing Corp.

One-Man Shop

Thirty years' experience as a foreman have taught me that it is bad management to run a shop on a one-man basis.

Although it has sometimes been said that a properly supervised shop will run itself, the success of any shop largely depends upon the right kind of supervision at all times. Therefore, if maximum results are to be secured by Al, it is necessary to have someone to take up the reins of supervision whenever he is absent.

During my foremanship it was the management's practice to have one of the gang bosses automatically take the responsibility in the shop when I was away. Additional remuneration was paid him for supervising the shop during my absence.

I have known shop executives who would set up many jobs; go to the toolroom for tools; and go out of their way to do various jobs, and yet their shops would not be efficient.

They had no time to plan their work, to judge their men or to watch their product. They kidded themselves into believing that the detail work they were doing could not possibly be done by someone else. —A. Eyles,
St. Albans, Hertfordshire, England.

Hiring Older Men

In a large plant in the Philadelphia area, where the operations are more or less seasonal, there has been a necessarily large labor turnover. Due to the "feast or famine" conditions prevalent in this plant, it has acquired an unsavory reputation and much difficulty is encountered in obtaining the right type of workers.

Recently, conditions became critical in one department, and the employment manager admitted that he could not take care of labor requisitions pertaining to toolmakers and machinists unless men 60 years of age or older were employed.

In consequence, this concern has acquired some "old timers" who are real assets. It is a pleasure to see the confidence they display and the manner in which they take hold and do a job. —Ira S. Williams.

What Is Productive Labor?

Overhead is a blanket term and covers a great many things. If the services of an executive in any way promote efficiency in production, his work is productive. Everyone employed in business is either a productive worker or an expensive ornament. Economically conducted business will not tolerate parasites in its employ. Whether any executive is a productive worker or a parasite is, therefore, a matter for the judgment of the management to determine after careful consideration.

Men who are kept at work by, what Ed called, policemen are not so efficient as men who are governed by their own interest in the work they are doing. An executive who is interested in his work can hardly avoid being a productive worker. Everything depends upon the incentives which are shaping the particular man's actions. It is to be remembered that in an economically conducted business all real overhead expenses are necessary expenses, and as such, essentially productive.

—W. E. Brokaw,
Executive Secretary,
The Equitist League.

This question harks back to the question, "Is Spending Ever Saving?" which was discussed in *American Machinist* several years ago. Most of us agreed that buying in quantity lots, buying at discount prices, buying bankrupt stocks, etc., was saving, even though we were spending. And "What Is Productive Labor?" is the same problem in other words.

We once hired an efficiency expert as a regular part of our personnel. He showed us how work that was ordinarily done in eight hours, could be done in seven hours. That gave us six more hours a week for production—almost a full day extra—and the increased production was valued at about $1,000 a week. We paid this efficiency expert $2,500 a year, and through him our production increased about $50,000 a year. The difference, a profit to us, was $47,500 a year. Yet this man's pay was increased overhead. Was it worth it?

While executives are non-producers in the general meaning of the word, it is often the executives who make the production worth what it is; who increase production and its value; and who open new markets. In each case it is an added income of thousands of dollars—far above the salaries commanded by the executives. Is it worth it? Of course it is. —Will Herman.

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Floating Bearings

Years ago we had a loose pulley on a countershaft that gave no end of trouble. There were two reasons for the chronic overheating: an overhang of the belt pull and a rather small bearing area. The old millwright took down the countershaft and asked me to bore out the hub for a bushing ¼-in. thick. I also made a cast-iron bushing that was a good running fit in the pulley hub and on the shaft. Next he had about a dozen ¼-in. holes drilled in the bushing and each hole countersunk on both sides. This was the first floating bushing I had seen, and it cured our troubles. Theoretically, at least, it cut the surface speed of the bearing in half, assuming the bushing had equal friction inside and out. The other day a friend showed me a new heavy duty milling machine with this same kind of bearing on the spindles except that he used bronze. But I still have a leaning toward close grained cast-iron where the bearing can have plenty of oil.

Shop Temperature and Its Cost

Shop temperature is a more important subject than many realize. The hours lost on cold mornings in the old shop would have paid for a lot of heat. The discomfort plus the resentment cost the boss a lot of dollars that he figured on saving. And we all recall cases of misfits between mating parts made in different corners of the shop. In these days of close tolerances uniform temperature is a vital problem. One shop owner I know finds it necessary to maintain a uniform temperature at all times, day and night, to insure the close fits required. The interesting point is that his bill for fuel is no more than when he let the shop cool down at night.

Cleaning Before Assembly

Close relationship betwen cleanliness and godliness may not be apparent, but no one can dispute that cleanliness in assembling parts is important in the satisfactory performance of any machine. The care taken in assembling automobile motors is both interesting and impressive. In the Dodge plant, for example, cleaning baths and sprays are in evidence all along the assembly line. All parts are washed in Sunoco spirits before they are put together to wash off any minute particles of dirt or dust that may have found a temporary resting place. All cleaning spirits are filtered each night so that no particles washed off today will cling to the motors assembled tomorrow.

Postponing the Chloroform

A hopeful sign of returning sanity on the part of at least one manager is shown by a recent advertisement in the *American Machinist* for a foreman over 40 years old. It gives all old timers quite a thrill, as it should. Measuring the ability of a man by age is a mighty poor inspection method. Calendar years mean much less than the mental age, and even here the best Binet test isn't always so good. The main thing we need is ability to weigh experience (your own and others) in the light of the present. One of the greatest compliments I ever heard paid a man over 60 was, "I never think of his age because he has young ideas."

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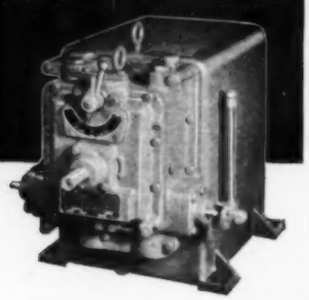

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